US008850241B2

(12) **United States Patent**
**Oler et al.**

(10) **Patent No.: US 8,850,241 B2**
(45) **Date of Patent: *Sep. 30, 2014**

(54) **MULTI-STAGE POWER ADAPTER CONFIGURED TO PROVIDE LOW POWER UPON INITIAL CONNECTION OF THE POWER ADAPTER TO THE HOST DEVICE AND HIGH POWER THEREAFTER UPON NOTIFICATION FROM THE HOST DEVICE TO THE POWER ADAPTER**

(71) Applicant: **Microsoft Corporation**, Redmond, WA (US)

(72) Inventors: **Van Winston Oler**, Redmond, WA (US); **Hiroo Umeno**, Seattle, WA (US)

(73) Assignee: **Microsoft Corporation**, Redmond, WA (US)

( * ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **13/651,287**

(22) Filed: **Oct. 12, 2012**

(65) **Prior Publication Data**

US 2013/0232349 A1 Sep. 5, 2013

**Related U.S. Application Data**

(63) Continuation of application No. 13/471,412, filed on May 14, 2012.

(60) Provisional application No. 61/606,333, filed on Mar. 2, 2012, provisional application No. 61/613,745, filed on Mar. 21, 2012, provisional application No. 61/607,451, filed on Mar. 6, 2012.

(51) **Int. Cl.**
***G06F 1/00*** (2006.01)
***G06F 1/32*** (2006.01)

(52) **U.S. Cl.**
USPC ..... **713/300**; 713/310

(58) **Field of Classification Search**
USPC ..... 713/300, 324, 340, 323; 370/352; 323/234; 345/1.1
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

578,325 A 3/1897 Fleming
3,879,586 A 4/1975 DuRocher et al.
(Continued)

FOREIGN PATENT DOCUMENTS

CA 990023 6/1976
CN 103455149 12/2013
(Continued)

OTHER PUBLICATIONS

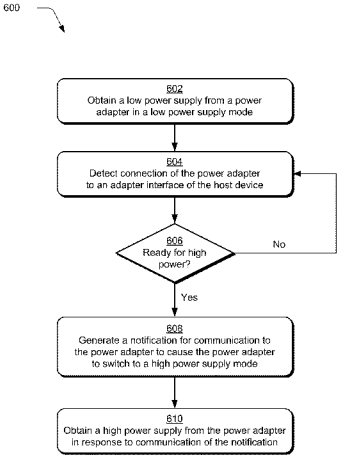
"Cholesteric Liquid Crystal", Retrieved from: <http://en.wikipedia.org/wiki/Cholesteric_liquid_crystal> on Aug. 6, 2012,(Jun. 10, 2012), 2 pages.
(Continued)

*Primary Examiner* — Thomas Lee
*Assistant Examiner* — Aurel Prifti
(74) *Attorney, Agent, or Firm* — Jeremy Snodgrass; Glen Johnson; Micky Minhas

(57) **ABSTRACT**

Multi-stage power adapter techniques are described in which a power adapter for a device is configured to selectively switch between a relatively low power supply and a relatively high power supply. The low power supply may be employed upon initial connection of the adapter to a host device to ensure that the adapter is safe when disconnected and does not supply full power before the device is ready to receive the high power supply. The low power supply may supply enough power for the host device to detect the connection of the adapter and establish initial communication with the adapter. A switch to the high power supply by the adapter may then occur in response to a notification from the host device that indicates the host device is ready for the high power supply. The switch to high power supply enables normal operation of the host device.

**20 Claims, 6 Drawing Sheets**


600
602
Obtain a low power supply from a power adapter in a low power supply mode
604
Detect connection of the power adapter to an adapter interface of the host device
606
Ready for high power?
No
Yes
608
Generate a notification for communication to the power adapter to cause the power adapter to switch to a high power supply mode
610
Obtain a high power supply from the power adapter in response to communication of the notification

(56) **References Cited**

U.S. PATENT DOCUMENTS

| | | | | |
|---|---|---|---|---|
| 4,046,975 | A | 9/1977 | Seeger, Jr. | |
| 4,065,649 | A | 12/1977 | Carter et al. | |
| 4,086,451 | A | 4/1978 | Boulanger | |
| 4,243,861 | A | 1/1981 | Strandwitz | |
| 4,302,648 | A | 11/1981 | Sado et al. | |
| 4,317,013 | A | 2/1982 | Larson | |
| 4,365,130 | A | 12/1982 | Christensen | |
| 4,492,829 | A | 1/1985 | Rodrique | |
| 4,527,021 | A | 7/1985 | Morikawa et al. | |
| 4,559,426 | A | 12/1985 | Van Zeeland et al. | |
| 4,576,436 | A | 3/1986 | Daniel | |
| 4,577,822 | A | 3/1986 | Wilkerson | |
| 4,588,187 | A | 5/1986 | Dell | |
| 4,607,147 | A | 8/1986 | Ono et al. | |
| 4,615,579 | A | 10/1986 | Whitehead | |
| 4,651,133 | A | 3/1987 | Ganesan et al. | |
| 4,735,394 | A | 4/1988 | Facco | |
| 5,008,497 | A | 4/1991 | Asher | |
| 5,128,829 | A | 7/1992 | Loew | |
| 5,220,521 | A | 6/1993 | Kikinis | |
| 5,249,978 | A | 10/1993 | Gazda et al. | |
| 5,283,559 | A | 2/1994 | Kalendra et al. | |
| 5,331,443 | A | 7/1994 | Stanisci | |
| 5,339,382 | A | 8/1994 | Whitehead | |
| 5,340,528 | A | 8/1994 | Machida et al. | |
| 5,363,075 | A | 11/1994 | Fanucchi | |
| 5,375,076 | A | 12/1994 | Goodrich et al. | |
| 5,406,415 | A | 4/1995 | Kelly | |
| 5,480,118 | A | 1/1996 | Cross | |
| 5,546,271 | A | 8/1996 | Gut et al. | |
| 5,548,477 | A | 8/1996 | Kumar et al. | |
| 5,558,577 | A | 9/1996 | Kato | |
| 5,576,981 | A | 11/1996 | Parker et al. | |
| 5,618,232 | A | 4/1997 | Martin | |
| 5,621,494 | A | 4/1997 | Kazumi et al. | |
| 5,666,112 | A | 9/1997 | Crowley et al. | |
| 5,681,220 | A | 10/1997 | Bertram et al. | |
| 5,737,183 | A | 4/1998 | Kobayashi et al. | |
| 5,745,376 | A | 4/1998 | Barker et al. | |
| 5,748,114 | A | 5/1998 | Koehn | |
| 5,781,406 | A | 7/1998 | Hunte | |
| 5,807,175 | A | 9/1998 | Davis et al. | |
| 5,818,361 | A | 10/1998 | Acevedo | |
| 5,828,770 | A | 10/1998 | Leis et al. | |
| 5,842,027 | A | 11/1998 | Oprescu et al. | |
| 5,861,990 | A | 1/1999 | Tedesco | |
| 5,874,697 | A | 2/1999 | Selker et al. | |
| 5,905,485 | A | 5/1999 | Podoloff | |
| 5,924,555 | A | 7/1999 | Sadamori et al. | |
| 5,926,170 | A | 7/1999 | Oba | |
| 5,929,946 | A | 7/1999 | Sharp et al. | |
| 5,957,191 | A | 9/1999 | Okada et al. | |
| 5,971,635 | A | 10/1999 | Wise | |
| 5,999,147 | A | 12/1999 | Teitel | |
| 6,002,389 | A | 12/1999 | Kasser | |
| 6,005,209 | A | 12/1999 | Burleson et al. | |
| 6,012,714 | A | 1/2000 | Worley et al. | |
| 6,040,823 | A | 3/2000 | Seffernick et al. | |
| 6,042,075 | A | 3/2000 | Burch, Jr. | |
| 6,044,717 | A | 4/2000 | Biegelsen et al. | |
| 6,046,857 | A | 4/2000 | Morishima | |
| 6,061,644 | A | 5/2000 | Leis | |
| 6,108,200 | A | 8/2000 | Fullerton | |
| 6,112,797 | A | 9/2000 | Colson et al. | |
| 6,128,007 | A | 10/2000 | Seybold | |
| 6,178,443 | B1 | 1/2001 | Lin | |
| 6,188,391 | B1 | 2/2001 | Seely et al. | |
| 6,228,926 | B1 | 5/2001 | Golumbic | |
| 6,232,934 | B1 | 5/2001 | Heacock et al. | |
| 6,234,820 | B1 | 5/2001 | Perino et al. | |
| 6,254,105 | B1 | 7/2001 | Rinde et al. | |
| 6,279,060 | B1 | 8/2001 | Luke et al. | |
| 6,300,986 | B1 | 10/2001 | Travis | |
| 6,329,617 | B1 | 12/2001 | Burgess | |
| 6,344,791 | B1 | 2/2002 | Armstrong | |
| 6,353,503 | B1 | 3/2002 | Spitzer et al. | |
| 6,366,440 | B1 | 4/2002 | Kung | |
| 6,380,497 | B1 | 4/2002 | Hashimoto et al. | |
| 6,437,682 | B1 | 8/2002 | Vance | |
| 6,506,983 | B1 | 1/2003 | Babb et al. | |
| 6,511,378 | B1 | 1/2003 | Bhatt et al. | |
| 6,532,147 | B1 | 3/2003 | Christ, Jr. | |
| 6,543,949 | B1 | 4/2003 | Ritchey et al. | |
| 6,565,439 | B2 | 5/2003 | Shinohara et al. | |
| 6,597,347 | B1 | 7/2003 | Yasutake | |
| 6,600,121 | B1 | 7/2003 | Olodort et al. | |
| 6,603,408 | B1 | 8/2003 | Gaba | |
| 6,608,664 | B1 | 8/2003 | Hasegawa | |
| 6,617,536 | B2 | 9/2003 | Kawaguchi | |
| 6,651,943 | B2 | 11/2003 | Cho et al. | |
| 6,685,369 | B2 | 2/2004 | Lien | |
| 6,695,273 | B2 | 2/2004 | Iguchi | |
| 6,704,864 | B1 | 3/2004 | Philyaw | |
| 6,721,019 | B2 | 4/2004 | Kono et al. | |
| 6,725,318 | B1 | 4/2004 | Sherman et al. | |
| 6,774,888 | B1 | 8/2004 | Genduso | |
| 6,776,546 | B2 | 8/2004 | Kraus et al. | |
| 6,780,019 | B1 | 8/2004 | Ghosh et al. | |
| 6,781,819 | B2 | 8/2004 | Yang et al. | |
| 6,784,869 | B1 | 8/2004 | Clark et al. | |
| 6,790,054 | B1 | 9/2004 | Boonsue | |
| 6,795,146 | B2 | 9/2004 | Dozov et al. | |
| 6,813,143 | B2 | 11/2004 | Makela | |
| 6,819,316 | B2 | 11/2004 | Schulz et al. | |
| 6,847,488 | B2 | 1/2005 | Travis | |
| 6,856,506 | B2 | 2/2005 | Doherty et al. | |
| 6,861,961 | B2 | 3/2005 | Sandbach et al. | |
| 6,898,315 | B2 | 5/2005 | Guha | |
| 6,909,354 | B2 | 6/2005 | Baker et al. | |
| 6,914,197 | B2 | 7/2005 | Doherty et al. | |
| 6,950,950 | B2 * | 9/2005 | Sawyers et al. | 713/300 |
| 6,970,957 | B1 | 11/2005 | Oshins et al. | |
| 6,976,799 | B2 | 12/2005 | Kim et al. | |
| 7,007,238 | B2 | 2/2006 | Glaser | |
| 7,018,678 | B2 | 3/2006 | Gronbeck et al. | |
| 7,025,908 | B1 | 4/2006 | Hayashi et al. | |
| 7,051,149 | B2 | 5/2006 | Wang et al. | |
| 7,068,496 | B2 | 6/2006 | Wong et al. | |
| 7,083,295 | B1 | 8/2006 | Hanna | |
| 7,091,436 | B2 | 8/2006 | Serban | |
| 7,095,404 | B2 | 8/2006 | Vincent et al. | |
| 7,099,149 | B2 | 8/2006 | Krieger et al. | |
| 7,101,048 | B2 | 9/2006 | Travis | |
| 7,106,222 | B2 | 9/2006 | Ward et al. | |
| 7,116,309 | B1 | 10/2006 | Kimura et al. | |
| 7,123,292 | B1 | 10/2006 | Seeger et al. | |
| 7,129,979 | B1 | 10/2006 | Lee | |
| 7,136,282 | B1 | 11/2006 | Rebeske | |
| 7,152,985 | B2 | 12/2006 | Benitez et al. | |
| D535,292 | S | 1/2007 | Shi et al. | |
| 7,194,662 | B2 | 3/2007 | Do et al. | |
| 7,199,931 | B2 | 4/2007 | Boettiger et al. | |
| 7,201,508 | B2 | 4/2007 | Misaras | |
| 7,213,323 | B2 | 5/2007 | Baker et al. | |
| 7,213,991 | B2 | 5/2007 | Chapman et al. | |
| 7,224,830 | B2 | 5/2007 | Nefian et al. | |
| 7,260,221 | B1 | 8/2007 | Atsmon | |
| 7,277,087 | B2 | 10/2007 | Hill et al. | |
| 7,301,759 | B2 | 11/2007 | Hsiung | |
| 7,311,526 | B2 | 12/2007 | Rohrbach et al. | |
| 7,331,793 | B2 | 2/2008 | Hernandez et al. | |
| 7,374,312 | B2 | 5/2008 | Feng et al. | |
| 7,447,934 | B2 | 11/2008 | Dasari et al. | |
| 7,457,108 | B2 | 11/2008 | Ghosh | |
| 7,467,948 | B2 | 12/2008 | Lindberg et al. | |
| 7,469,386 | B2 | 12/2008 | Bear et al. | |
| 7,486,165 | B2 | 2/2009 | Ligtenberg et al. | |
| 7,499,037 | B2 | 3/2009 | Lube | |
| 7,499,216 | B2 | 3/2009 | Niv et al. | |
| 7,502,803 | B2 | 3/2009 | Culter et al. | |
| 7,515,143 | B2 | 4/2009 | Keam et al. | |
| 7,542,052 | B2 | 6/2009 | Solomon et al. | |
| 7,558,594 | B2 | 7/2009 | Wilson | |
| 7,559,834 | B1 | 7/2009 | York | |

(56) **References Cited**

U.S. PATENT DOCUMENTS

7,561,131 B2 7/2009 Ijzerman et al.
RE40,891 E 9/2009 Yasutake
7,620,244 B1 11/2009 Collier
7,636,921 B2 12/2009 Louie
7,639,876 B2 12/2009 Clary et al.
7,643,213 B2 1/2010 Boettiger et al.
7,656,392 B2 2/2010 Bolender
7,686,694 B2 3/2010 Cole
7,722,792 B2 5/2010 Uezaki et al.
7,728,923 B2 6/2010 Kim et al.
7,729,493 B2 6/2010 Krieger et al.
7,731,147 B2 6/2010 Rha
7,733,326 B1 6/2010 Adiseshan
7,773,076 B2 8/2010 Pittel et al.
7,773,121 B1 8/2010 Huntsberger et al.
7,774,155 B2 8/2010 Sato et al.
7,777,972 B1 8/2010 Chen et al.
7,782,342 B2 8/2010 Koh
7,813,715 B2 10/2010 McKillop et al.
7,815,358 B2 10/2010 Inditsky
7,822,338 B2 10/2010 Wernersson
7,855,716 B2 12/2010 McCreary et al.
7,865,639 B2 1/2011 McCoy et al.
7,884,807 B2 2/2011 Hovden et al.
7,893,921 B2 2/2011 Sato
7,898,797 B2 3/2011 Fan et al.
D636,397 S 4/2011 Green
7,918,559 B2 4/2011 Tesar
7,927,654 B2 4/2011 Hagood et al.
7,928,964 B2 4/2011 Kolmykov-Zotov et al.
7,936,501 B2 5/2011 Smith et al.
7,944,520 B2 5/2011 Ichioka et al.
7,945,717 B2 5/2011 Rivalsi
7,967,462 B2 6/2011 Ogiro et al.
7,970,246 B2 6/2011 Travis et al.
7,973,771 B2 7/2011 Geaghan
7,976,393 B2 7/2011 Haga et al.
7,978,281 B2 7/2011 Vergith et al.
8,016,255 B2 9/2011 Lin
8,018,386 B2 9/2011 Qi et al.
8,018,579 B1 9/2011 Krah
8,026,904 B2 9/2011 Westerman
8,053,688 B2 11/2011 Conzola et al.
8,065,624 B2 11/2011 Morin et al.
8,069,356 B2 11/2011 Rathi et al.
RE42,992 E 12/2011 David
8,077,160 B2 12/2011 Land et al.
8,090,885 B2 1/2012 Callaghan et al.
8,098,233 B2 1/2012 Hotelling et al.
8,102,362 B2 1/2012 Ricks et al.
8,115,499 B2 2/2012 Osoinach et al.
8,115,718 B2 2/2012 Chen et al.
8,117,362 B2 2/2012 Rodriguez et al.
8,118,274 B2 2/2012 McClure et al.
8,118,681 B2 2/2012 Mattice et al.
8,120,166 B2 2/2012 Koizumi et al.
8,130,203 B2 3/2012 Westerman
8,149,219 B2 4/2012 Lii et al.
8,154,524 B2 4/2012 Wilson et al.
8,162,282 B2 4/2012 Hu et al.
D659,139 S 5/2012 Gengler
8,169,421 B2 5/2012 Wright et al.
8,179,236 B2 5/2012 Weller et al.
8,184,190 B2 5/2012 Dosluoglu
8,189,973 B2 5/2012 Travis et al.
8,216,074 B2 7/2012 Sakuma
8,229,509 B2 7/2012 Paek et al.
8,229,522 B2 7/2012 Kim et al.
8,231,099 B2 7/2012 Chen
8,248,791 B2 8/2012 Wang et al.
8,255,708 B1 8/2012 Zhang
8,264,310 B2 9/2012 Lauder et al.
8,267,368 B2 9/2012 Torii et al.
8,269,731 B2 9/2012 Molne
8,274,784 B2 9/2012 Franz et al.
8,279,589 B2 10/2012 Kim
8,310,768 B2 11/2012 Lin et al.
8,322,290 B1 12/2012 Mignano
8,342,857 B2 1/2013 Palli et al.
8,373,664 B2 2/2013 Wright
8,387,078 B2 2/2013 Memmott
8,416,559 B2 4/2013 Agata et al.
8,498,100 B1 7/2013 Whitt, III et al.
8,543,227 B1 9/2013 Perek et al.
8,548,608 B2 10/2013 Perek et al.
8,564,944 B2 10/2013 Whitt, III et al.
8,570,725 B2 10/2013 Whitt, III et al.
8,599,542 B1 12/2013 Healey et al.
8,610,015 B2 12/2013 Whitt et al.
8,614,666 B2 12/2013 Whitman et al.
8,646,999 B2 2/2014 Shaw et al.
8,699,215 B2 4/2014 Whitt, III et al.
8,719,603 B2 5/2014 Belesiu
8,724,302 B2 5/2014 Whitt et al.
8,780,541 B2 7/2014 Whitt et al.
8,791,382 B2 7/2014 Whitt, III et al.
2001/0023818 A1 9/2001 Masaru et al.
2002/0044216 A1 4/2002 Cha
2002/0134828 A1 9/2002 Sandbach et al.
2002/0135457 A1 9/2002 Sandbach et al.
2002/0163510 A1 11/2002 Williams et al.
2003/0011576 A1 1/2003 Sandbach et al.
2003/0016282 A1 1/2003 Koizumi
2003/0036365 A1 2/2003 Kuroda
2003/0051983 A1 3/2003 Lahr
2003/0108720 A1 6/2003 Kashino
2003/0132916 A1 7/2003 Kramer
2003/0163611 A1 8/2003 Nagao
2003/0165017 A1 9/2003 Amitai
2003/0197687 A1 10/2003 Shetter
2003/0198008 A1 10/2003 Leapman et al.
2003/0231243 A1 12/2003 Shibutani
2004/0005184 A1 1/2004 Kim et al.
2004/0048941 A1 3/2004 Raffel et al.
2004/0056843 A1 3/2004 Lin et al.
2004/0100457 A1 5/2004 Mandle
2004/0115994 A1 6/2004 Wulff et al.
2004/0156168 A1 8/2004 LeVasseur et al.
2004/0160734 A1 8/2004 Yim
2004/0169641 A1 9/2004 Bean et al.
2004/0212598 A1 10/2004 Kraus et al.
2004/0212601 A1 10/2004 Cake et al.
2004/0258924 A1 12/2004 Berger et al.
2004/0268000 A1 12/2004 Barker et al.
2005/0030728 A1 2/2005 Kawashima et al.
2005/0052831 A1 3/2005 Chen
2005/0055498 A1 3/2005 Beckert et al.
2005/0057515 A1 3/2005 Bathiche
2005/0059489 A1 3/2005 Kim
2005/0062715 A1 3/2005 Tsuji et al.
2005/0099400 A1 5/2005 Lee
2005/0100690 A1 5/2005 Mayer et al.
2005/0134717 A1 6/2005 Misawa
2005/0146512 A1 7/2005 Hill et al.
2005/0236848 A1 10/2005 Kim
2005/0264653 A1 12/2005 Starkweather et al.
2005/0264988 A1 12/2005 Nicolosi
2005/0285703 A1 12/2005 Wheeler et al.
2006/0028400 A1 2/2006 Lapstun et al.
2006/0049993 A1 3/2006 Lin et al.
2006/0085658 A1* 4/2006 Allen et al. ..... 713/310
2006/0092139 A1 5/2006 Sharma
2006/0096392 A1 5/2006 Inkster et al.
2006/0102914 A1 5/2006 Smits et al.
2006/0125799 A1 6/2006 Hillis et al.
2006/0132423 A1 6/2006 Travis
2006/0154725 A1 7/2006 Glaser et al.
2006/0156415 A1 7/2006 Rubinstein et al.
2006/0181514 A1 8/2006 Newman
2006/0187216 A1 8/2006 Trent, Jr. et al.
2006/0195522 A1 8/2006 Miyazaki
2006/0197755 A1 9/2006 Bawany
2006/0227393 A1 10/2006 Herloski
2006/0238510 A1 10/2006 Panotopoulos et al.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2006/0238550 A1 10/2006 Page
2006/0254042 A1 11/2006 Chou et al.
2006/0265617 A1 11/2006 Priborsky
2006/0272429 A1 12/2006 Ganapathi et al.
2006/0279501 A1 12/2006 Lu et al.
2007/0003267 A1 1/2007 Shibutani
2007/0047221 A1 3/2007 Park
2007/0056385 A1 3/2007 Lorenz
2007/0062089 A1 3/2007 Homer et al.
2007/0069153 A1 3/2007 Pai-Paranjape et al.
2007/0072474 A1 3/2007 Beasley et al.
2007/0081091 A1 4/2007 Pan et al.
2007/0116929 A1 5/2007 Fujimori et al.
2007/0117600 A1 5/2007 Robertson et al.
2007/0145945 A1 6/2007 McGinley et al.
2007/0161262 A1 7/2007 Lloyd
2007/0176902 A1 8/2007 Newman et al.
2007/0182663 A1 8/2007 Biech
2007/0182722 A1 8/2007 Hotelling et al.
2007/0185590 A1 8/2007 Reindel et al.
2007/0188478 A1 8/2007 Silverstein et al.
2007/0200830 A1 8/2007 Yamamoto
2007/0201859 A1 8/2007 Sarrat
2007/0220708 A1 9/2007 Lewis
2007/0230227 A1 10/2007 Palmer
2007/0234420 A1 10/2007 Novotney et al.
2007/0236408 A1* 10/2007 Yamaguchi et al. ..... 345/1.1
2007/0236475 A1 10/2007 Wherry
2007/0236873 A1 10/2007 Yukawa et al.
2007/0247338 A1 10/2007 Marchetto
2007/0247432 A1 10/2007 Oakley
2007/0260892 A1 11/2007 Paul et al.
2007/0274094 A1 11/2007 Schultz et al.
2007/0274095 A1 11/2007 Destain
2007/0283179 A1* 12/2007 Burnett et al. ..... 713/324
2007/0296709 A1 12/2007 Guanghai
2008/0005423 A1 1/2008 Jacobs et al.
2008/0013809 A1 1/2008 Zhu et al.
2008/0053222 A1 3/2008 Ehrensvard et al.
2008/0059888 A1 3/2008 Dunko
2008/0068451 A1 3/2008 Hyatt
2008/0074398 A1 3/2008 Wright
2008/0104437 A1* 5/2008 Lee ..... 713/323
2008/0106592 A1 5/2008 Mikami
2008/0122803 A1 5/2008 Izadi et al.
2008/0150913 A1 6/2008 Bell et al.
2008/0151478 A1 6/2008 Chern
2008/0158185 A1 7/2008 Westerman
2008/0167832 A1 7/2008 Soss
2008/0174570 A1 7/2008 Jobs et al.
2008/0180411 A1 7/2008 Solomon et al.
2008/0182622 A1 7/2008 Makarowski et al.
2008/0186660 A1 8/2008 Yang
2008/0219025 A1 9/2008 Spitzer et al.
2008/0225205 A1 9/2008 Travis
2008/0228969 A1 9/2008 Cheah et al.
2008/0232061 A1 9/2008 Wang et al.
2008/0238884 A1 10/2008 Harish
2008/0253822 A1 10/2008 Matias
2008/0297878 A1 12/2008 Brown et al.
2008/0309636 A1 12/2008 Feng et al.
2008/0316002 A1 12/2008 Brunet et al.
2008/0316183 A1 12/2008 Westerman et al.
2008/0320190 A1 12/2008 Lydon et al.
2009/0007001 A1 1/2009 Morin et al.
2009/0009476 A1 1/2009 Daley, III
2009/0033623 A1 2/2009 Lin
2009/0073060 A1 3/2009 Shimasaki et al.
2009/0073957 A1* 3/2009 Newland et al. ..... 370/352
2009/0079639 A1 3/2009 Hotta et al.
2009/0083562 A1 3/2009 Park et al.
2009/0089600 A1 4/2009 Nousiainen
2009/0096738 A1 4/2009 Chen et al.
2009/0127005 A1 5/2009 Zachut et al.
2009/0140985 A1 6/2009 Liu
2009/0163147 A1 6/2009 Steigerwald et al.
2009/0167728 A1 7/2009 Geaghan et al.
2009/0167930 A1 7/2009 Safaee-Rad et al.
2009/0174759 A1 7/2009 Yeh et al.
2009/0189873 A1 7/2009 Peterson et al.
2009/0189974 A1 7/2009 Deering
2009/0195497 A1 8/2009 Fitzgerald et al.
2009/0207144 A1 8/2009 Bridger
2009/0231275 A1 9/2009 Odgers
2009/0239586 A1 9/2009 Boeve et al.
2009/0244832 A1 10/2009 Behar et al.
2009/0251008 A1 10/2009 Sugaya
2009/0259865 A1* 10/2009 Sheynblat et al. ..... 713/323
2009/0262492 A1 10/2009 Whitchurch et al.
2009/0265670 A1 10/2009 Kim et al.
2009/0285491 A1 11/2009 Ravenscroft et al.
2009/0296331 A1 12/2009 Choy
2009/0303137 A1 12/2009 Kusaka et al.
2009/0303204 A1 12/2009 Nasiri et al.
2009/0315830 A1 12/2009 Westerman
2009/0320244 A1 12/2009 Lin
2009/0321490 A1 12/2009 Groene et al.
2010/0001963 A1 1/2010 Doray et al.
2010/0013319 A1 1/2010 Kamiyama et al.
2010/0026656 A1 2/2010 Hotelling et al.
2010/0038821 A1 2/2010 Jenkins et al.
2010/0039081 A1 2/2010 Sip
2010/0045609 A1 2/2010 Do et al.
2010/0045633 A1 2/2010 Gettemy
2010/0051356 A1 3/2010 Stern et al.
2010/0051432 A1 3/2010 Lin et al.
2010/0052880 A1 3/2010 Laitinen et al.
2010/0053534 A1 3/2010 Hsieh et al.
2010/0053771 A1 3/2010 Travis et al.
2010/0072351 A1 3/2010 Mahowald
2010/0077237 A1* 3/2010 Sawyers ..... 713/300
2010/0081377 A1 4/2010 Chatterjee et al.
2010/0085321 A1 4/2010 Pundsack
2010/0102182 A1 4/2010 Lin
2010/0102206 A1 4/2010 Cazaux et al.
2010/0103112 A1 4/2010 Yoo et al.
2010/0123686 A1 5/2010 Klinghult et al.
2010/0133398 A1 6/2010 Chiu et al.
2010/0142130 A1 6/2010 Wang et al.
2010/0148995 A1 6/2010 Elias
2010/0148999 A1 6/2010 Casparian et al.
2010/0149073 A1 6/2010 Chaum et al.
2010/0149104 A1 6/2010 Sim et al.
2010/0149111 A1 6/2010 Olien
2010/0149117 A1 6/2010 Chien et al.
2010/0149134 A1 6/2010 Westerman et al.
2010/0149377 A1 6/2010 Shintani et al.
2010/0156798 A1 6/2010 Archer
2010/0156913 A1 6/2010 Ortega et al.
2010/0161522 A1 6/2010 Tirpak et al.
2010/0164857 A1 7/2010 Liu et al.
2010/0164897 A1 7/2010 Morin et al.
2010/0171891 A1 7/2010 Kaji et al.
2010/0174421 A1 7/2010 Tsai et al.
2010/0177388 A1 7/2010 Cohen et al.
2010/0180063 A1 7/2010 Ananny et al.
2010/0188299 A1 7/2010 Rinehart et al.
2010/0188338 A1 7/2010 Longe
2010/0205472 A1 8/2010 Tupman et al.
2010/0206614 A1 8/2010 Park et al.
2010/0206644 A1 8/2010 Yeh
2010/0214214 A1 8/2010 Corson et al.
2010/0214257 A1 8/2010 Wussler et al.
2010/0222110 A1 9/2010 Kim et al.
2010/0231498 A1 9/2010 Large et al.
2010/0231510 A1 9/2010 Sampsell et al.
2010/0231556 A1 9/2010 Mines et al.
2010/0235546 A1 9/2010 Terlizzi et al.
2010/0238075 A1 9/2010 Pourseyed
2010/0238138 A1 9/2010 Goertz et al.
2010/0238620 A1 9/2010 Fish
2010/0245221 A1 9/2010 Khan
2010/0250988 A1 9/2010 Okuda et al.
2010/0259482 A1 10/2010 Ball

(56) **References Cited**

U.S. PATENT DOCUMENTS

2010/0265182 A1 10/2010 Ball et al.
2010/0271771 A1 10/2010 Wu et al.
2010/0274932 A1 10/2010 Kose
2010/0279768 A1 11/2010 Huang et al.
2010/0282953 A1 11/2010 Tam
2010/0289457 A1* 11/2010 Onnerud et al. ..... 320/162
2010/0295812 A1 11/2010 Burns et al.
2010/0296163 A1 11/2010 Saarikko
2010/0302378 A1 12/2010 Marks et al.
2010/0304793 A1 12/2010 Kim et al.
2010/0306538 A1 12/2010 Thomas et al.
2010/0308778 A1* 12/2010 Yamazaki et al. ..... 323/234
2010/0308844 A1 12/2010 Day et al.
2010/0309617 A1 12/2010 Wang et al.
2010/0313680 A1 12/2010 Joung et al.
2010/0315348 A1 12/2010 Jellicoe et al.
2010/0315373 A1 12/2010 Steinhauser et al.
2010/0315774 A1 12/2010 Walker et al.
2010/0321339 A1 12/2010 Kimmel
2010/0321877 A1 12/2010 Moser
2010/0324457 A1 12/2010 Bean et al.
2010/0325155 A1 12/2010 Skinner et al.
2010/0331059 A1 12/2010 Apgar et al.
2011/0007047 A1 1/2011 Fujioka et al.
2011/0012873 A1 1/2011 Prest et al.
2011/0019123 A1 1/2011 Prest et al.
2011/0031287 A1 2/2011 Le Gette et al.
2011/0032127 A1 2/2011 Roush
2011/0032215 A1 2/2011 Sirotich et al.
2011/0036965 A1 2/2011 Zhang et al.
2011/0037721 A1 2/2011 Cranfill et al.
2011/0043990 A1 2/2011 Mickey et al.
2011/0050576 A1 3/2011 Forutanpour et al.
2011/0050626 A1 3/2011 Porter et al.
2011/0055407 A1 3/2011 Lydon et al.
2011/0057724 A1 3/2011 Pabon
2011/0060926 A1* 3/2011 Brooks et al. ..... 713/300
2011/0069148 A1 3/2011 Jones et al.
2011/0072391 A1 3/2011 Hanggie et al.
2011/0074688 A1 3/2011 Hull et al.
2011/0081946 A1 4/2011 Singh
2011/0096035 A1 4/2011 Shen
2011/0102326 A1 5/2011 Casparian et al.
2011/0102356 A1 5/2011 Kemppinen et al.
2011/0115738 A1 5/2011 Suzuki et al.
2011/0115747 A1 5/2011 Powell et al.
2011/0117970 A1 5/2011 Young
2011/0118025 A1 5/2011 Lukas et al.
2011/0122071 A1 5/2011 Powell
2011/0134032 A1 6/2011 Chiu et al.
2011/0134112 A1 6/2011 Koh et al.
2011/0157046 A1 6/2011 Lee et al.
2011/0157087 A1 6/2011 Kanehira et al.
2011/0163955 A1 7/2011 Nasiri et al.
2011/0164370 A1 7/2011 McClure et al.
2011/0167181 A1 7/2011 Minoo et al.
2011/0167287 A1 7/2011 Walsh et al.
2011/0167391 A1 7/2011 Momeyer et al.
2011/0167992 A1 7/2011 Eventoff et al.
2011/0169762 A1 7/2011 Weiss
2011/0169778 A1 7/2011 Nungester et al.
2011/0170289 A1 7/2011 Allen et al.
2011/0176035 A1 7/2011 Poulsen
2011/0179864 A1 7/2011 Raasch et al.
2011/0184646 A1 7/2011 Wong et al.
2011/0184824 A1 7/2011 George et al.
2011/0188199 A1 8/2011 Pan
2011/0193787 A1 8/2011 Morishige et al.
2011/0193938 A1 8/2011 Oderwald et al.
2011/0202878 A1 8/2011 Park et al.
2011/0205372 A1 8/2011 Miramontes
2011/0216266 A1 9/2011 Travis
2011/0221659 A1 9/2011 King et al.
2011/0227913 A1 9/2011 Hyndman
2011/0228462 A1 9/2011 Dang
2011/0231682 A1 9/2011 Kakish et al.
2011/0234502 A1 9/2011 Yun et al.
2011/0242138 A1 10/2011 Tribble
2011/0242440 A1 10/2011 Noma et al.
2011/0242670 A1 10/2011 Simmonds
2011/0248152 A1 10/2011 Svajda et al.
2011/0248920 A1 10/2011 Larsen
2011/0248941 A1 10/2011 Abdo et al.
2011/0261001 A1 10/2011 Liu
2011/0261083 A1 10/2011 Wilson
2011/0267272 A1 11/2011 Meyer et al.
2011/0273475 A1 11/2011 Herz et al.
2011/0290686 A1 12/2011 Huang
2011/0295697 A1 12/2011 Boston et al.
2011/0297566 A1 12/2011 Gallagher et al.
2011/0298919 A1 12/2011 Maglaque
2011/0302518 A1 12/2011 Zhang
2011/0304577 A1 12/2011 Brown
2011/0304815 A1 12/2011 Newell
2011/0305875 A1 12/2011 Sanford et al.
2011/0306424 A1 12/2011 Kazama et al.
2011/0307242 A1 12/2011 Qu
2011/0316807 A1 12/2011 Corrion
2012/0007821 A1 1/2012 Zaliva
2012/0011462 A1 1/2012 Westerman et al.
2012/0013519 A1 1/2012 Hakansson et al.
2012/0021618 A1 1/2012 Schultz
2012/0023459 A1 1/2012 Westerman
2012/0024682 A1 2/2012 Huang et al.
2012/0026048 A1 2/2012 Vazquez et al.
2012/0026096 A1 2/2012 Ku
2012/0032887 A1 2/2012 Chiu et al.
2012/0032891 A1 2/2012 Parivar
2012/0033369 A1 2/2012 Wu et al.
2012/0038495 A1 2/2012 Ishikawa
2012/0044179 A1 2/2012 Hudson
2012/0047368 A1 2/2012 Chinn et al.
2012/0050975 A1 3/2012 Garelli et al.
2012/0062850 A1 3/2012 Travis
2012/0069540 A1 3/2012 Lauder et al.
2012/0071008 A1 3/2012 Sessford
2012/0075249 A1 3/2012 Hoch
2012/0077384 A1 3/2012 Bar-Niv et al.
2012/0081316 A1 4/2012 Sirpal et al.
2012/0087078 A1 4/2012 Medica et al.
2012/0092279 A1 4/2012 Martin
2012/0094257 A1 4/2012 Pillischer et al.
2012/0099749 A1 4/2012 Rubin et al.
2012/0113579 A1 5/2012 Agata et al.
2012/0115553 A1 5/2012 Mahe et al.
2012/0117409 A1* 5/2012 Lee et al. ..... 713/340
2012/0127118 A1 5/2012 Nolting et al.
2012/0140396 A1 6/2012 Zeliff et al.
2012/0145525 A1 6/2012 Ishikawa
2012/0162693 A1 6/2012 Ito
2012/0175487 A1 7/2012 Goto
2012/0182242 A1 7/2012 Lindahl et al.
2012/0182249 A1 7/2012 Endo et al.
2012/0182743 A1 7/2012 Chou
2012/0194393 A1 8/2012 Uttermann et al.
2012/0194448 A1 8/2012 Rothkopf
2012/0200802 A1 8/2012 Large
2012/0206937 A1 8/2012 Travis et al.
2012/0223866 A1 9/2012 Ayala Vazquez et al.
2012/0224073 A1 9/2012 Miyahara
2012/0229634 A1 9/2012 Laett et al.
2012/0235635 A1 9/2012 Sato
2012/0243165 A1 9/2012 Chang et al.
2012/0246377 A1 9/2012 Bhesania
2012/0249443 A1 10/2012 Anderson et al.
2012/0256959 A1 10/2012 Ye et al.
2012/0274811 A1 11/2012 Bakin
2012/0299872 A1 11/2012 Nishikawa et al.
2012/0300275 A1 11/2012 Vilardell et al.
2012/0312955 A1 12/2012 Randolph
2013/0009413 A1 1/2013 Chiu et al.
2013/0016468 A1 1/2013 Oh
2013/0017696 A1 1/2013 Alvarez Rivera
2013/0027867 A1 1/2013 Lauder et al.

(56) **References Cited**

U.S. PATENT DOCUMENTS

| | | | | |
|---|---|---|---|---|
| 2013/0044074 | A1 | 2/2013 | Park et al. | |
| 2013/0063873 | A1 | 3/2013 | Wodrich et al. | |
| 2013/0067126 | A1 | 3/2013 | Casparian et al. | |
| 2013/0073877 | A1 | 3/2013 | Radke | |
| 2013/0076617 | A1 | 3/2013 | Csaszar et al. | |
| 2013/0088431 | A1 | 4/2013 | Ballagas et al. | |
| 2013/0106766 | A1 | 5/2013 | Yilmaz et al. | |
| 2013/0107144 | A1 | 5/2013 | Marhefka et al. | |
| 2013/0162554 | A1 | 6/2013 | Lauder et al. | |
| 2013/0172906 | A1 | 7/2013 | Olson et al. | |
| 2013/0207937 | A1 | 8/2013 | Lutian et al. | |
| 2013/0217451 | A1 | 8/2013 | Komiyama et al. | |
| 2013/0227836 | A1 | 9/2013 | Whitt, III et al. | |
| 2013/0228023 | A1 | 9/2013 | Drasnin et al. | |
| 2013/0228433 | A1 | 9/2013 | Shaw et al. | |
| 2013/0228434 | A1 | 9/2013 | Whitt, III et al. | |
| 2013/0228435 | A1 | 9/2013 | Whitt, III et al. | |
| 2013/0228439 | A1 | 9/2013 | Whitt, III et al. | |
| 2013/0229100 | A1 | 9/2013 | Siddiqui et al. | |
| 2013/0229335 | A1 | 9/2013 | Whitman et al. | |
| 2013/0229347 | A1 | 9/2013 | Lutz, III et al. | |
| 2013/0229350 | A1 | 9/2013 | Shaw et al. | |
| 2013/0229351 | A1 | 9/2013 | Whitt, III et al. | |
| 2013/0229354 | A1 | 9/2013 | Whitt, III et al. | |
| 2013/0229356 | A1 | 9/2013 | Marwah et al. | |
| 2013/0229363 | A1 | 9/2013 | Whitman et al. | |
| 2013/0229366 | A1 | 9/2013 | Dighde et al. | |
| 2013/0229380 | A1 | 9/2013 | Lutz, III et al. | |
| 2013/0229386 | A1 | 9/2013 | Bathiche et al. | |
| 2013/0229534 | A1 | 9/2013 | Panay et al. | |
| 2013/0229568 | A1 | 9/2013 | Belesiu et al. | |
| 2013/0229570 | A1 | 9/2013 | Beck et al. | |
| 2013/0229756 | A1 | 9/2013 | Whitt, III et al. | |
| 2013/0229757 | A1 | 9/2013 | Whitt, III et al. | |
| 2013/0229758 | A1 | 9/2013 | Belesiu et al. | |
| 2013/0229759 | A1 | 9/2013 | Whitt, III et al. | |
| 2013/0229760 | A1 | 9/2013 | Whitt, III et al. | |
| 2013/0229761 | A1 | 9/2013 | Shaw et al. | |
| 2013/0229762 | A1 | 9/2013 | Whitt, III et al. | |
| 2013/0229773 | A1 | 9/2013 | Siddiqui et al. | |
| 2013/0230346 | A1 | 9/2013 | Shaw et al. | |
| 2013/0231755 | A1 | 9/2013 | Perek et al. | |
| 2013/0232280 | A1 | 9/2013 | Perek et al. | |
| 2013/0232348 | A1 | 9/2013 | Oler et al. | |
| 2013/0232350 | A1 | 9/2013 | Belesiu et al. | |
| 2013/0232353 | A1 | 9/2013 | Belesiu et al. | |
| 2013/0232571 | A1 | 9/2013 | Belesiu et al. | |
| 2013/0242495 | A1 | 9/2013 | Bathiche et al. | |
| 2013/0262886 | A1* | 10/2013 | Nishimura | 713/300 |
| 2013/0300590 | A1 | 11/2013 | Dietz | |
| 2013/0300647 | A1 | 11/2013 | Drasnin | |
| 2013/0301199 | A1 | 11/2013 | Whitt | |
| 2013/0301206 | A1 | 11/2013 | Whitt | |
| 2013/0304941 | A1 | 11/2013 | Drasnin | |
| 2013/0304944 | A1 | 11/2013 | Young et al. | |
| 2013/0322000 | A1 | 12/2013 | Whitt | |
| 2013/0322001 | A1 | 12/2013 | Whitt | |
| 2013/0329360 | A1 | 12/2013 | Aldana | |
| 2013/0332628 | A1 | 12/2013 | Panay | |
| 2013/0335330 | A1 | 12/2013 | Lane et al. | |
| 2013/0335902 | A1 | 12/2013 | Campbell et al. | |
| 2013/0335903 | A1 | 12/2013 | Raken et al. | |
| 2013/0339757 | A1* | 12/2013 | Reddy | 713/300 |
| 2013/0342465 | A1 | 12/2013 | Bathiche et al. | |
| 2013/0346636 | A1 | 12/2013 | Bathiche et al. | |
| 2014/0012401 | A1 | 1/2014 | Perek | |
| 2014/0043275 | A1 | 2/2014 | Whitman | |
| 2014/0048399 | A1 | 2/2014 | Whitt, III | |
| 2014/0078063 | A1 | 3/2014 | Bathiche et al. | |
| 2014/0119802 | A1 | 5/2014 | Shaw et al. | |
| 2014/0132550 | A1 | 5/2014 | McCracken et al. | |
| 2014/0185215 | A1 | 7/2014 | Whitt | |
| 2014/0185220 | A1 | 7/2014 | Whitt | |
| 2014/0204514 | A1 | 7/2014 | Whitt | |
| 2014/0204515 | A1 | 7/2014 | Whitt | |

FOREIGN PATENT DOCUMENTS

| | | |
|---|---|---|
| EP | 1223722 | 7/2002 |
| EP | 1591891 | 11/2005 |
| EP | 2026178 | 2/2009 |
| EP | 2353978 | 8/2011 |
| GB | 2123213 | 1/1984 |
| GB | 2178570 | 2/1987 |
| JP | 56108127 | 8/1981 |
| JP | 10301055 | 11/1998 |
| JP | 10326124 | 12/1998 |
| JP | 1173239 | 3/1999 |
| JP | 11338575 | 12/1999 |
| JP | 2000010654 | 1/2000 |
| JP | 2001142564 | 5/2001 |
| JP | 2004038950 | 2/2004 |
| JP | 2006163459 | 6/2006 |
| JP | 2006294361 | 10/2006 |
| JP | 2009122551 | 6/2009 |
| JP | 2010244514 | 10/2010 |
| KR | 20010107055 | 12/2001 |
| KR | 20040066647 | 7/2004 |
| KR | 20050014299 | 2/2005 |
| KR | 20060003093 | 1/2006 |
| KR | 20080006404 | 1/2008 |
| KR | 20090029411 | 3/2009 |
| KR | 20100022059 | 2/2010 |
| KR | 20100067366 | 6/2010 |
| KR | 20100115675 | 10/2010 |
| KR | 20110064265 | 6/2011 |
| KR | 1020110087178 | 8/2011 |
| KR | 20110109791 | 10/2011 |
| KR | 20110120002 | 11/2011 |
| KR | 20110122333 | 11/2011 |
| KR | 101113530 | 2/2012 |
| NL | 1038411 | 5/2012 |
| WO | WO-9964784 | 12/1999 |
| WO | WO-0079327 | 12/2000 |
| WO | WO 2006044818 | 4/2006 |
| WO | WO-2007112172 | 10/2007 |
| WO | WO-2009034484 | 3/2009 |
| WO | WO-2010011983 | 1/2010 |
| WO | WO-2011049609 | 4/2011 |
| WO | WO-2013012699 | 1/2013 |

OTHER PUBLICATIONS

"Cirago Slim Case®—Protective case with built-in kickstand for your iPhone 5®", Retrieved from <http://cirago.com/wordpress/wp-content/uploads/2012/10/ipc1500brochure1.pdf> on Jan. 29, 2013, (Jan. 2013),1 page.

"DR2PA", retrieved from <http://www.architainment.co.uk/wp-content/uploads/2012/08/DR2PA-AU-US-size-Data-Sheet-Rev-H_LOGO.pdf> on Sep. 17, 2012, 4 pages.

"How to Use the iPad's Onscreen Keyboard", Retrieved from <http://www.dummies.com/how-to/content/how-to-use-the-ipads-onscreen-keyboard.html> on Aug. 28, 2012, 3 pages.

"i-Interactor electronic pen", Retrieved from: <http://www.alibaba.com/product-gs/331004878/i_Interactor_electronic_pen.html> on Jun. 19, 2012, 5 pages.

"MPC Fly Music Production Controller", *AKAI Professional*, Retrieved from: http://www.akaiprompc.com/mpc-fly> on July 9, 2012, 4 pages.

"NI Releases New Maschine & Maschine Mikro", Retrieved from <http://www.djbooth.net/index/dj-equipment/entry/ni-releases-new-maschine-mikro/> on Sep. 17, 2012, 19 pages.

"Non-Final Office Action", U.S. Appl. No. 13/471,001, (Feb. 19, 2013),15 pages.

"Non-Final Office Action", U.S. Appl. No. 13/471,139, (Mar. 21, 2013),12 pages.

"Non-Final Office Action", U.S. Appl. No. 13/471,202, (Feb. 11, 2013),10 pages.

"Non-Final Office Action", U.S. Appl. No. 13/471,336, (Jan. 18, 2013),14 pages.

"Non-Final Office Action", U.S. Appl. No. 13/651,195, (Jan. 2, 2013),14 pages.

(56) **References Cited**

OTHER PUBLICATIONS

"Non-Final Office Action", U.S. Appl. No. 13/651,232, (Jan. 17, 2013),15 pages.
"Non-Final Office Action", U.S. Appl. No. 13/651,272, (Feb. 12, 2013),10 pages.
"Non-Final Office Action", U.S. Appl. No. 13/651,304, (Mar. 22, 2013), 9 pages.
"Non-Final Office Action", U.S. Appl. No. 13/651,327, (Mar. 22, 2013), 6 pages.
"Non-Final Office Action", U.S. Appl. No. 13/651,871, (Mar. 18, 2013),14 pages.
"Non-Final Office Action", U.S. Appl. No. 13/651,976, (Feb. 22, 2013),16 pages.
"Non-Final Office Action", U.S. Appl. No. 13/653,321, (Feb. 1, 2013),13 pages.
"Non-Final Office Action", U.S. Appl. No. 13/653,682, (Feb. 7, 2013),11 pages.
"Notice of Allowance", U.S. Appl. No. 13/470,633, (Mar. 22, 2013), 7 pages.
"On-Screen Keyboard for Windows 7, Vista, XP with Touchscreen", Retrieved from <www.comfort-software.com/on-screen-keyboard.html> on Aug. 28, 2012, (Feb. 2, 2011), 3 pages.
"Reflex LCD Writing Tablets", retrieved from <http://www.kentdisplays.com/products/lcdwritingtablets.html> on Jun. 27, 2012, 3 pages.
"Restriction Requirement", U.S. Appl. No. 13/471,139, (Jan. 17, 2013), 7 pages.
"Restriction Requirement", U.S. Appl. No. 13/651,304, (Jan. 18, 2013), 7 pages.
"Restriction Requirement", U.S. Appl. No. 13/651,726, (Feb. 22, 2013), 6 pages.
"Restriction Requirement", U.S. Appl. No. 13/651,871, (Feb. 7, 2013), 6 pages.
"SMART Board™ Interactive Display Frame Pencil Pack", Available at <http://downloads01.smarttech.com/media/sitecore/en/support/product/sbfpd/400series(interactivedisplayframes)/guides/smartboardinteractivedisplayframepencilpackv12mar09.pdf>,(2009), 2 pages.
"The Microsoft Surface Tablets Comes With Impressive Design and Specs", Retrieved from <http://microsofttabletreview.com/the-microsoft-surface-tablets-comes-with-impressive-design-and-specs> on Jan. 30, 2013, (Jun. 2012), 2 pages.
"Tilt Shift Lenses: Perspective Control", retrieved from http://www.cambridgeincolour.com/tutorials/tilt-shift-lenses1.htm, (Mar. 28, 2008),11 Pages.
"What is Active Alignment?", http://www.kasalis.com/active_alignment.html, retrieved on Nov. 22, 2012, 2 pages.
Das, Apurba et al., "Study of Heat Transfer through Multilayer Clothing Assemblies: A Theoretical Prediction", Retrieved from <http://www.autexrj.com/cms/zalaczone_pliki/5_013_11.pdf>, (Jun. 2011), 7 pages.
Piltch, Avram "ASUS Eee Pad Slider SL101 Review", Retrieved from <http://www.laptopmag.com/review/tablets/asus-eee-pad-slider-sl101.aspx>, (Sep. 22, 2011), 5 pages.
Qin, Yongqiang et al., "pPen: Enabling Authenticated Pen and Touch Interaction on Tabletop Surfaces", in *Proceedings of ITS* 2010, Available at <http://www.dfki.de/its2010/papers/pdf/po172.pds>, (Nov. 2010), pp. 283-284.
Sumimoto, Mark "Touch & Write: Surface Computing With Touch and Pen Input", Retrieved from: <http://www.gottabemobile.com/2009/08/07/touch-write-surface-computing-with-touch-and-pen-input/> on Jun. 19, 2012,(Aug. 7, 2009), 4 pages.
Valliath, G T., "Design of Hologram for Brightness Enhancement in Color LCDs", Retrieved from <http://www.loreti.it/Download/PDF/LCD/44_05.pdf> on Sep. 17, 2012, 5 pages.
Williams, Jim "A Fourth Generation of LCD Backlight Technology", Retrieved from <http://cds.linear.com/docs/Application%20Note/an65f.pdf>, (Nov. 1995), 124 pages.
"Accessing Device Sensors", retrieved from <https://developer.palm.com/content/api/dev-guide/pdk/accessing-device-sensors.html>on May 25, 2012, 4 pages.
"ACPI Docking for Windows Operating Systems", Retrieved from: <http://www.scritube.com/limba/engleza/software/ACPI-Docking-for-Windows-Opera331824193.php> on Jul. 6, 2012, 10 pages.
"First One Handed Fabric Keyboard with Bluetooth Wireless Technology", Retrieved from: <http://press.xtvworld.com/article3817.html> on May 8, 2012,(Jan. 6, 2005), 2 pages.
"Force and Position Sensing Resistors: An Emerging Technology", *Interlink Electronics*, Available at <http://staff.science.uva.nl/~vlaander/docu/FSR/An_Exploring_Technology.pdf>,(Feb. 1990), pp. 1-6.
"Frogpad Introduces Weareable Fabric Keyboard with Bluetooth Technology", Retrieved from: <http://www.geekzone.co.nz/content.asp?contentid=3898> on May 7, 2012,(Jan. 7, 2005), 3 pages.
"Incipio LG G-Slate Premium Kickstand Case—Black Nylon", Retrieved from: <http://www.amazon.com/Incipio-G-Slate-Premium-Kickstand-Case/dp/B004ZKP916> on May 8, 2012, 4 pages.
"Membrane Keyboards & Membrane Keypads", Retrieved from: <http://www.pannam.com/> on May 9, 2012,(Mar. 4, 2009),2 pages.
"Motion Sensors", *Android Developers*, retrieved from <http://developer.android.com/guide/topics/sensors/sensors_motion.html> on May 25, 2012, 7 pages.
"Position Sensors", *Android Developers*, retrieved from <http://developer.android.com/guide/topics/sensors/sensors_position.html> on May 25, 2012, 5 pages.
"SolRxTM E-Series Multidirectional Phototherapy ExpandableTM 2-Bulb Full Body Panel System", Retrieved from: <http://www.solarcsystems.com/us_multidirectional_uv_light_therapy_1_intro.html > on Jul. 25, 2012,(2011), 4 pages.
"Virtualization Getting Started Guide", *Red Hat Enterprise Linux* 6, *Edition* 0.2, retrieved from <http://docs.redhat.com/docs/en-US/Red_Hat_Enterprise_Linux/6/html-single/Virtualization_Getting_Started_Guide/index.html> on Jun. 13, 2012, 24 pages.
Block, Steve et al., "DeviceOrientation Event Specification", *W3C, Editor's Draft*, retrieved from <https://developer.palm.com/content/api/dev-guide/pdk/accessing-device-sensors.html> on May 25, 2012,(Jul. 12, 2011), 14 pages.
Brown, Rich "Microsoft Shows Off Pressure-Sensitive Keyboard", retrieved from <http://news.cnet.com/8301-17938_105-10304792-1.html> on May 7, 2012, (Aug. 6, 2009), 2 pages.
Butler, Alex et al., "SideSight: Multi-"touch" Interaction around Small Devices", in *the proceedings of the* 21*st annual ACM symposium on User interface software and technology*., retrieved from <http://research.microsoft.com/pubs/132534/sidesight_crv3.pdf> on May 29, 2012,(Oct. 19, 2008), 4 pages.
Crider, Michael "Sony Slate Concept Tablet "Grows" a Kickstand", Retrieved from: < http://androidcommunity.com/sony-slate-concept-tablet-grows-a-kickstand-20120116/>on May 4, 2012,(Jan. 16, 2012), 9 pages.
Dietz, Paul H., et al., "A Practical Pressure Sensitive Computer Keyboard", in Proceedings of UIST 2009,(Oct. 2009), 4 pages.
Glatt, Jeff "Channel and Key Pressure (Aftertouch).", Retrieved from: <http://home.roadrunner.com/~jgglatt/tutr/touch.htm> on Jun. 11, 2012, 2 pages.
Hanlon, Mike "ElekTex Smart Fabric Keyboard Goes Wireless", Retrieved from: <http://www.gizmag.com/go/5048/ > on May 7, 2012,(Jan. 15, 2006), 5 pages.
Kaur, Sukhmani "Vincent Liew's redesigned laptop satisfies ergonomic needs", Retrieved from: <http://www.designbuzz.com/entry/vincent-liew-s-redesigned-laptop-satisfies-ergonomic-needs/> on Jul. 27, 2012,(Jun. 21, 2010), 4 pages.
Khuntontong, Puttachat et al., "Fabrication of Molded Interconnection Devices by Ultrasonic Hot Embossing on Thin Polymer Films", IEEE Transactions on Electronics Packaging Manufacturing, vol. 32, No. 3,(Jul. 2009), pp. 152-156.
Linderholm, Owen "Logitech Shows Cloth Keyboard for PDAs", Retrieved from: <http://www.pcworld.com/article/89084/logitech_shows_cloth_keyboard_for_pdas.html> on May 7, 2012,(Mar. 15, 2002), 5 pages.

(56) **References Cited**

OTHER PUBLICATIONS

McLellan, Charles "Eleksen Wireless Fabric Keyboard: a first look", Retrieved from: <http://www.zdnetasia.com/eleksen-wireless-fabric-keyboard-a-first-look-40278954.htm> on May 7, 2012,(Jul. 17, 2006), 9 pages.

Post, E.R. et al., "E-Broidery: Design and Fabrication of Textile-Based Computing", IBM Systems Journal, vol. 39, Issue 3 & 4,(Jul. 2000), pp. 840-860.

Purcher, Jack "Apple is Paving the Way for a New 3D GUI for IOS Devices", Retrieved from: <http://www.patentlyapple.com/patently-apple/2012/01/apple-is-paving-the-way-for-a-new-3d-gui-for-ios-devices.html> on Jun. 4, 2012,(Jan. 12, 2012), 15 pages.

Takamatsu, Seiichi et al., "Flexible Fabric Keyboard with Conductive Polymer-Coated Fibers", in Proceedings of Sensors 2011,(Oct. 28, 2011), 4 pages.

Zhang, et al., "Model-Based Development of Dynamically Adaptive Software", in *Proceedings of ICSE* 2006, Available at <http://www.irisa.fr/lande/lande/icse-proceedings/icse/p371.pdf>,(May 20, 2006), pp. 371-380.

"Advanced Configuration and Power Management Specification", *Intel Corporation, Microsoft Corporation, Toshiba Corp. Revision* 1, (Dec. 22, 1996), 364 pages.

"Corrected Notice of Allowance", U.S. Appl. No. 13/651,327, (Sep. 12, 2013), 2 pages.

"Corrected Notice of Allowance", U.S. Appl. No. 13/651,327, (Sep. 23, 2013), 2 pages.

"Corrected Notice of Allowance", U.S. Appl. No. 13/651,726, (Sep. 17, 2013), 2 pages.

"Final Office Action", U.S. Appl. No. 13/471,139, (Sep. 16, 2013),13 pages.

"Final Office Action", U.S. Appl. No. 13/471,336, (Aug. 28, 2013),18 pages.

"Final Office Action", U.S. Appl. No. 13/653,321, (Aug. 2, 2013),17 pages.

"Final Office Action", U.S. Appl. No. 13/653,682, (Oct. 18, 2013),16 pages.

"Final Office Action", U.S. Appl. No. 13/656,055, (Oct. 23, 2013),14 pages.

"Non-Final Office Action", U.S. Appl. No. 13/938,930, (Aug. 29, 2013), 9 pages.

"Non-Final Office Action", U.S. Appl. No. 13/939,002, (Aug. 28, 2013), 6 pages.

"Non-Final Office Action", U.S. Appl. No. 13/939,032, (Aug. 29, 2013), 7 pages.

"Notice of Allowance", U.S. Appl. No. 13/651,871, (Oct. 2, 2013), 7 pages.

"Notice to Grant", Chinese Application No. 201320097089.9, (Sep. 29, 2013), 2 Pages.

"PCT Search Report and Written Opinion", Application No. PCT/US2013/040968, (Sep. 5, 2013), 12 pages.

"PCT Search Report and Written Opinion", Application No. PCT/US2013/045049, (Sep. 16, 2013), 9 pages.

"Corrected Notice of Allowance", U.S. Appl. No. 13/470,633, (Apr. 9, 2013), 2 pages.

"Corrected Notice of Allowance", U.S. Appl. No. 13/470,633, (Jul. 2, 2013), 2 pages.

"Final Office Action", U.S. Appl. No. 13/651,195, (Apr. 18, 2013), 13 pages.

"Final Office Action", U.S. Appl. No. 13/651,232, (May 21, 2013), 21 pages.

"Non-Final Office Action", U.S. Appl. No. 13/563,435, (Jun. 14, 2013), 6 pages.

"Non-Final Office Action", U.S. Appl. No. 13/564,520, (Jun. 19, 2013), 8 pages.

"Non-Final Office Action", U.S. Appl. No. 13/565,124, (Jun. 17, 2013), 5 pages.

"Non-Final Office Action", U.S. Appl. No. 13/651,726, (Apr. 15, 2013), 6 pages.

"Non-Final Office Action", U.S. Appl. No. 13/651,871, (Jul. 1, 2013), 5 pages.

"Non-Final Office Action", U.S. Appl. No. 13/653,682, (Jun. 3, 2013), 14 pages.

"Non-Final Office Action", U.S. Appl. No. 13/656,055, (Apr. 23, 2013), 11 pages.

"Notice of Allowance", U.S. Appl. No. 13/471,202, (May 28, 2013), 7 pages.

"Notice of Allowance", U.S. Appl. No. 13/651,272, (May 2, 2013), 7 pages.

"Notice of Allowance", U.S. Appl. No. 13/651,304, (Jul. 1, 2013), 5 pages.

"Notice of Allowance", U.S. Appl. No. 13/651,327, (Jun. 11, 2013), 7 pages.

"Notice of Allowance", U.S. Appl. No. 13/651,726, (May 31, 2013), 5 pages.

"Corrected Notice of Allowance", U.S. Appl. No. 13/563,435, Mar. 20, 2014, 2 pages.

"Corrected Notice of Allowance", U.S. Appl. No. 13/565,124, Apr. 3, 2014, 4 pages.

"Corrected Notice of Allowance", U.S. Appl. No. 13/565,124, Mar. 10, 2014, 2 pages.

"Corrected Notice of Allowance", U.S. Appl. No. 13/565,124, Apr. 14, 2014, 2 pages.

"Final Office Action", U.S. Appl. No. 13/780,228, Mar. 28, 2014, 13 pages.

"Foreign Office Action", CN Application No. 201320328022.1, Feb. 17, 2014, 4 Pages.

"Foreign Office Action", CN Application No. 201320328022.1, Oct. 18, 2013, 3 Pages.

"Non-Final Office Action", U.S. Appl. No. 13/471,237, Mar. 24, 2014, 7 pages.

"Non-Final Office Action", U.S. Appl. No. 13/471,376, Apr. 2, 2014, 17 pages.

"Non-Final Office Action", U.S. Appl. No. 13/527,263, Apr. 3, 2014, 6 pages.

"Non-Final Office Action", U.S. Appl. No. 14/199,924, Apr. 10, 2014, 6 pages.

"Non-Final Office Action", U.S. Appl. No. 14/200,595, Apr. 11, 2014, 4 pages.

"Notice of Allowance", U.S. Appl. No. 13/939,032, Apr. 3, 2014, 4 pages.

"Supplemental Notice of Allowance", U.S. Appl. No. 13/653,321, Mar. 28, 2014, 4 pages.

"Final Office Action", U.S. Appl. No. 13/471,001, Jul. 25, 2013, 20 pages.

"Final Office Action", U.S. Appl. No. 13/651,976, Jul. 25, 2013, 21 pages.

"Non-Final Office Action", U.S. Appl. No. 13/527,263, Jul. 19, 2013, 5 pages.

"Notice of Allowance", U.S. Appl. No. 13/651,195, Jul. 8, 2013, 9 pages.

"PCT Search Report and Written Opinion", Application No. PCT/US2013/028948, Jun. 21, 2013, 11 pages.

"PCT Search Report and Written Opinion", Application No. PCT/US2013/029461, Jun. 21, 2013, 11 pages.

"Non-Final Office Action", U.S. Appl. No. 14/063,912, Jan. 2, 2014, 10 pages.

"Final Office Action", U.S. Appl. No. 13/938,930, Nov. 8, 2013, 10 pages.

"Non-Final Office Action", U.S. Appl. No. 13/780,228, Oct. 30, 2013, 12 pages.

"FingerWorks Installation and Operation Guide for the TouchStream ST and TouchStream LP", FingerWorks, Inc. Retrieved from <http://ec1.images-amazon.com/media/i3d/01/A/man-migrate/MANUAL000049862.pdf>, 2002, 14 pages.

"Non-Final Office Action", U.S. Appl. No. 13/651,232, Dec. 5, 2013, 15 pages.

"Non-Final Office Action", U.S. Appl. No. 13/468,918, Dec. 26, 2013, 18 pages.

"Corrected Notice of Allowance", U.S. Appl. No. 13/563,435, Jan. 14, 2014, 2 pages.

"Notice to Grant", CN Application No. 201320097124.7, Oct. 8, 2013, 2 pages.

(56) **References Cited**

OTHER PUBLICATIONS

"Notice of Allowance", U.S. Appl. No. 13/653,321, Dec. 18, 2013, 41 pages.
"Foreign Office Action", Chinese Application No. 201320097066.8, Oct. 24, 2013, 5 Pages.
"Notice of Allowance", U.S. Appl. No. 13/563,435, Nov. 12, 2013, 5 pages.
"Non-Final Office Action", U.S. Appl. No. 13/939,002, Dec. 20, 2013, 5 pages.
"Final Office Action", U.S. Appl. No. 13/939,032, Dec. 20, 2013, 5 pages.
"Restriction Requirement", U.S. Appl. No. 13/468,918, Nov. 29, 2013, 6 pages.
"Notice of Allowance", U.S. Appl. No. 13/565,124, Dec. 24, 2013, 6 pages.
"Final Office Action", U.S. Appl. No. 13/564,520, Jan. 15, 2014, 7 pages.
"Final Office Action", U.S. Appl. No. 13/939,002, Nov. 8, 2013, 7 pages.
"Non-Final Office Action", U.S. Appl. No. 13/653,682, Feb. 26, 2014, 10 pages.
"Advisory Action", U.S. Appl. No. 13/939,032, Feb. 24, 2014, 2 pages.
"Corrected Notice of Allowance", U.S. Appl. No. 13/563,435, Jan. 22, 2014, 2 pages.
"Non-Final Office Action", U.S. Appl. No. 13/599,635, Feb. 25, 2014, 13 pages.
"Non-Final Office Action", U.S. Appl. No. 13/471,186, Feb. 27, 2014, 8 pages.
"Non-Final Office Action", U.S. Appl. No. 13/471,405, Feb. 20, 2014, 37 pages.
"Non-Final Office Action", U.S. Appl. No. 13/564,520, Feb. 14, 2014, 5 pages.
"Non-Final Office Action", U.S. Appl. No. 13/656,055, Mar. 12, 2014, 17 pages.
"Notice of Allowance", U.S. Appl. No. 13/471,139, Mar. 17, 2014, 4 pages.
"Notice of Allowance", U.S. Appl. No. 13/938,930, Feb. 20, 2014, 4 pages.
"Notice of Allowance", U.S. Appl. No. 13/939,002, Mar. 3, 2014, 4 pages.
"Corrected Notice of Allowance", U.S. Appl. No. 13/651,232, Jul. 31, 2014, 2 pages.
"Corrected Notice of Allowance", U.S. Appl. No. 13/939,032, Jun. 26, 2014, 2 pages.
"Corrected Notice of Allowance", U.S. Appl. No. 13/939,032, Jul. 15, 2014, 2 pages.
"International Search Report and Written Opinion", Application No. PCT/US2014/031531, Jun. 20, 2014, 10 Pages.
"International Search Report and Written Opinion", Application No. PCT/US2013/028483, Jun. 24, 2014, 10 pages.
"International Search Report and Written Opinion", Application No. PCT/US2013/028484, Jun. 24, 2014, 10 pages.
"International Search Report and Written Opinion", Application No. PCT/US2013/028485, Jun. 25, 2014, 10 pages.
"International Search Report and Written Opinion", Application No. PCT/US2013/028769, Jun. 26, 2014, 10 pages.
"International Search Report and Written Opinion", Application No. PCT/US2013/028771, Jun. 19, 2014, 10 pages.
"International Search Report and Written Opinion", Application No. PCT/US2013/028486, Jun. 20, 2014, 10 pages.
"International Search Report and Written Opinion", Application No. PCT/US2013/041017, Jul. 17, 2014, 10 pages.
"International Search Report and Written Opinion", Application No. PCT/US2013/028489, Jun. 20, 2014, 11 pages.
"International Search Report and Written Opinion", Application No. PCT/US2013/028488, Jun. 24, 2014, 11 pages.
"International Search Report and Written Opinion", Application No. PCT/US2013/028767, Jun. 24, 2014, 11 pages.
"International Search Report and Written Opinion", Application No. PCT/US2013/028481, Jun. 19, 2014, 11 pages.
"International Search Report and Written Opinion", Application No. PCT/US2013/028490, Jun. 24, 2014, 11 pages.
"International Search Report and Written Opinion", Application No. PCT/US2013/028766, Jun. 26, 2014, 11 pages.
"International Search Report and Written Opinion", Application No. PCT/US2013/028772, Jun. 30, 2014, 11 pages.
"International Search Report and Written Opinion", Application No. PCT/US2013/028768, Jun. 24, 2014, 12 pages.
"International Search Report and Written Opinion", Application No. PCT/US2013/028482, Jun. 20, 2014, 13 pages.
"International Search Report and Written Opinion", Application No. PCT/US2013/028487, May 27, 2014, 9 pages.
"International Search Report and Written Opinion", Application No. PCT/US2013/028770, Jun. 26, 2014, 9 pages.
"Non-Final Office Action", U.S. Appl. No. 13/468,882, Jul. 9, 2014, 9 pages.
"Non-Final Office Action", U.S. Appl. No. 13/468,949, Jun. 20, 2014, 10 pages.
"Non-Final Office Action", U.S. Appl. No. 13/470,951, Jul. 2, 2014, 19 pages.
"Non-Final Office Action", U.S. Appl. No. 13/471,412, Jul. 11, 2014, 22 pages.
"Non-Final Office Action", U.S. Appl. No. 13/647,479, Jul. 3, 2014, 10 pages.
"Notice of Allowance", U.S. Appl. No. 13/471,186, Jul. 3, 2014, 7 pages.
"Notice of Allowance", U.S. Appl. No. 13/471,405, Jun. 24, 2014, 9 pages.
"Apple®—45W MagSafe 2 Power Adapter with Magnetic DC Connector -", Retrieved from <http://www.bestbuy.com/site/Apple%26%23174%3B—45W-MagSafe-2-Power-Adapter-with-Magnetic-DC-Connector/5856526.p?id=1218696408860&skuId=5856526#tab=overview> on May 14, 2013, 2013, 4 Pages.
"Developing Next-Generation Human Interfaces using Capacitive and Infrared Proximity Sensing", Silicon Laboratories, Inc., Available at <http://www.silabs.com/pages/DownloadDoc.aspx?FILEURL=support%20documents/technicaldocs/capacitive%20and%20proximity%20sensing_wp.pdf&src=SearchResults>, Aug. 3, 2010, pp. 1-10.
"Directional Backlighting for Display Panels", U.S. Appl. No. 13/021,448, Feb. 4, 2011, 38 pages.
"For Any Kind of Proceeding 2011 Springtime as Well as Coil Nailers as Well as Hotter Summer Season", Lady Shoe Worlds, retrieved from <http://www.ladyshoesworld.com/2011/09/18/for-any-kind-of-proceeding-2011- springtime-as-well-as-coil-nailers-as-well-as-hotter-summer-season/> on Nov. 3, 2011, Sep. 8, 2011, 2 pages.
"Foreign Notice of Allowance", CN Application No. 201320096755.7, Jan. 27, 2014, 2 pages.
"Foreign Office Action", CN Application No. 201320097079.5, Sep. 26, 2013, 4 pages.
"iControlPad—The open source controller", Retrieved from <http://www.kickstarter.com/projects/1703567677/icontrolpad-2-the-open-sou rcecontroller> on Nov. 20, 2012, 2012, 15 pages.
"Interlink Electronics FSR (TM) Force Sensing Resistors (TM)", Retrieved at <<http://akizukidenshi.com/download/ds/interlinkelec/94-00004+Rev+B%2OFSR%201ntegration%20Guide.pdf on Mar. 21, 2013, 36 pages.
"International Search Report and Written Opinion", Application No. PCT/US2013/028479, Jun. 17, 2013, 10 pages.
"International Search Report and Written Opinion", Application No. PCT/US2013/044871, Aug. 14, 2013, 12 pages.
"International Search Report and Written Opinion", Application No. PCT/US2011/050471, Apr. 9, 2012, 8 pages.
"Microsoft Develops Glasses-Free Eye-Tracking 3D Display", Tech-FAQ—retrieved from <http://www.tech-faq.com/microsoft-develops-glasses-free-eye-tracking-3d-display.html> on Nov. 2, 2011, Nov. 2, 2011, 3 pages.
"Microsoft Reveals Futuristic 3D Virtual HoloDesk Patent", Retrieved from <http://www.patentbolt.com/2012/05/microsoft-reveals-futuristic-3d-virtual-holodesk-patent.htmlt> on May 28, 2012, May 23, 2012, 9 pages.

(56) **References Cited**

OTHER PUBLICATIONS

"Molex:PCI Express Mini Card Connector, Right Angle, Low-Profile, Mid-Mount 0.80mm (.031") Pitch, Retrieved from <http://rhu004.sma-promail.com/SQLImages/kelmscott/Molex/PDF_Images/987650-4441.PDF> on Feb. 6, 2013, 2010, 3 pages.
"Non-Final Office Action", U.S. Appl. No. 12/882,994, Feb. 1, 2013, 17 pages.
"Non-Final Office Action", U.S. Appl. No. 13/021,448, Dec. 13, 2012, 9 pages.
"Non-Final Office Action", U.S. Appl. No. 13/371,725, Nov. 7, 2013, 19 pages.
"Non-Final Office Action", U.S. Appl. No. 13/603,918, Dec. 19, 2013, 12 pages.
"Non-Final Office Action", U.S. Appl. No. 13/645,405, Jan. 31, 2014, 6 pages.
"Non-Final Office Action", U.S. Appl. No. 13/656,520, Feb. 1, 2013, 15 pages.
"Non-Final Office Action", U.S. Appl. No. 13/656,520, Jun. 5, 2013, 8 pages.
"Notice of Allowance", U.S. Appl. No. 13/656,520, Oct. 2, 2013, 5 pages.
"Optical Sensors in Smart Mobile Devices", ON Semiconductor, TND415/D, Available at <http://www.onsemi.jp/pub_link/Collateral/TND415-D.PDF>, Nov. 2010, pp. 1-13.
"Optics for Displays: Waveguide-based Wedge Creates Collimated Display Backlight", OptoIQ, retrieved from <http://www.optoiq.com/index/photonics-technologies-applications/Ifw-display/Ifw-article-display.articles.laser-focus-world.volume-46.issue-1.world-news.optics-for_displays.html> on Nov. 2, 2010, Jan. 1, 2010, 3 pages.
"PCI Express® SMT Connector | FCI", Retrieved from <http://www.ttiinc.com/object/fp_fci_PCISMT> on Feb. 6, 2013, Feb. 2013, 1 page.
"Restriction Requirement", U.S. Appl. No. 13/603,918, Nov. 27, 2013, 8 pages.
"Restriction Requirement", U.S. Appl. No. 13/715,133, Oct. 28, 2013, 6 pages.
"Restriction Requirement", U.S. Appl. No. 13/715,133, Dec. 3, 2013, 6 pages.
"Restriction Requirement", U.S. Appl. No. 13/715,229, Aug. 13, 2013, 7 pages.
"RoPD® Connectors", Retrieved from <http://www.rosenberger.de/documents/headquarters_de_en/ba_automotive/AUTO_RoPD_Flyer_2012.pdf> on May 14, 2013, Jun. 2012, 6 pages.
"Write & Learn Spellboard Advanced", Available at <http://somemanuals.com/VTECH,WRITE%2526LEARN—Spellboard—ADV—71000,JIDFHE.PDF>, 2006, 22 pages.
Bathiche, et al., "Input Device with Interchangeable Surface", U.S. Appl. No. 13/974,749, Aug. 23, 2013, 51 pages.
Bert, et al., "Passive Matrix Addressing of Electrophoretic Image Display", Conference on International Display Research Conference, Retrieved from <http://www.cmst.be/publi/eurodisplay2002_s14-1.pdf>, Oct. 1, 2002, 4 pages.
"ThinkSafe: A Magnetic Power Connector for Thinkpads", Retrieved from <http://www.instructables.com/id/ThinkSafe%3A-A-Magnetic-Power-Connector-for-Thinkpad/> on May 14, 2013, Oct. 26, 2006, 9 pages.
Burge, et al., "Determination of off-axis aberrations of imaging systems using on-axis measurements", SPIE Proceeding, Retrieved from <http://www.loft.optics.arizona.edu/documents/journal_articles/Jim_Burge_Determination_of_off-axis_aberrations_of_imaging_systems_using_on-axis_measurements.pdf>, Sep. 21, 2011, 10 pages.
Chang, et al., "Optical Design and Analysis of LCD Backlight Units Using ASAP", Optical Engineering, Available at <http://www.opticsvalley.com/resources/kbasePDF/ma_oe_001_optical_design.pdf>, Jun. 2003, 15 pages.
Diverdi, et al., "An Immaterial Pseudo-3D Display with 3D Interaction", In the proceedings of Three-Dimensional Television: Capture, Transmission, and Display, Springer, Retrieved from <http://www.cs.ucsb.edu/~holl/pubs/DiVerdi-2007-3DTV.pdf>, Feb. 6, 2007, 26 pages.
Gaver, et al., "A Virtual Window on Media Space", retrieved from <http://www.gold.ac.uk/media/15gaver-smets-overbeeke.MediaSpaceWindow.chi95.pdf> on Jun. 1, 2012, retrieved from <http://www.gold.ac.uk/media/15gaver-smets-overbeeke.MediaSpaceWindow.chi95.pdf> on Jun. 1, 2012, May 7, 1995, 9 pages.
Grossman, et al., "Multi-Finger Gestural Interaction with 3D Volumetric Displays", in the proceedings of the 17th annual ACM symposium on User interface software and technology, Retrieved from <http://www.dgp.toronto.edu/papers/tgrossman_UIST2004.pdf>, Oct. 24, 2004, 61-70.
Harada, et al., "VoiceDraw: A Hands-Free Voice-Driven Drawing Application for People With Motor Impairments", In Proceedings of Ninth International ACM SIGACCESS Conference on Computers and Accessibility, retrieved from < http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.113.7211&rep=rep1&type=pdf> on Jun. 1, 2012, Oct. 15, 2007, 8 pages.
Hinckley, et al., "Codex: A Dual Screen Tablet Computer", Conference on Human Factors in Computing Systems, Apr. 9, 2009, 10 pages.
"Multistep Sequential Batch Assembly of Three-Dimensional Ferromagnetic Microstructures with Elastic Hinges", Retrieved at <<http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=1549861>> Proceedings: Journal of Microelectromechanical Systems, Dec. 2005, 7 pages.
Izadi, et al., "ThinSight: A Thin Form-Factor Interactive Surface Technology", Communications of the ACM, vol. 52, No. 12, retrieved from <http://research.microsoft.com/pubs/132532/p90-izadi.pdf> on Jan. 5, 2012, Dec. 2009, pp. 90-98.
Jacobs, et al., "2D/3D Switchable Displays", In the proceedings of Sharp Technical Journal (4), Available at <https://cgi.sharp.co.jp/corporate/rd/journal-85/pdf/85-04.pdf>, Apr. 2003, pp. 15-18.
Kaufmann, et al., "Hand Posture Recognition Using Real-time Artificial Evolution", EvoApplications'09, retrieved from <http://evelyne.lutton.free.fr/Papers/KaufmannEvolASP2010.pdf> on Jan. 5, 2012, Apr. 3, 2010, 10 pages.
Lane, et al., "Media Processing Input Device", U.S. Appl. No. 13/655,065, Oct. 18, 2012, 43 pages.
"Flat-Panel Autostereoscopic 3D Display", Optoelectronics, IET, Available at <http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=04455550>, Feb. 2008, pp. 24-28.
Lee, et al., "Depth-Fused 3D Imagery on an Immaterial Display", In the proceedings of IEEE Transactions on Visualization and Computer Graphics, vol. 15, No. 1, Retrieved from <http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=04540094>, Jan. 2009, 20-33.
Lee, et al., "LED Light Coupler Design for a Ultra Thin Light Guide", Journal of the Optical Society of Korea, vol. 11, Issue.3, Retrieved from <http://opticslab.kongju.ac.kr/pdf/06.pdf>, Sep. 2007, 5 pages.
Li, et al., "Characteristic Mode Based Tradeoff Analysis of Antenna-Chassis Interactions for Multiple Antenna Terminals", in IEEE Transactions on Antennas and Propagation, Retrieved from <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=6060882>, Feb. 2012, 13 pages.
Liu, et al., "Three-dimensional PC: toward novel forms of human-computer interaction", In the proceedings of Three-Dimensional Video and Display: Devices and Systems vol. CR76, Retrieved from <http://www.google.co.in/url?sa=t&rct=j&q=Three-dimensional+PC:+toward+novel+forms+of+human-computer+interaction&source=web&cd=1&ved=0CFoQFjAA&url=http%3A%2F%2Fciteseerx.ist.psu.edu%2Fviewdoc%2Fdownload%3Fdoi%3D10.1.1.32.9469°%26rep%3Drep1%26, Nov. 5, 2000, 250-281.
Manresa-Yee, et al., "Experiences Using a Hands-Free Interface", In Proceedings of the 10th International ACM SIGACCESS Conference on Computers and Accessibility, retrieved from <http://dmi.uib.es/~cmanresay/Research%5BMan08%5DAssets08.pdf> on Jun. 1, 2012, Oct. 13, 2008, pp. 261-262.
McLellan, "Microsoft Surface Review", Retrieved from <http://www.zdnet.com/microsoft-surface-review-7000006968/> on May 13, 2013, Nov. 6, 2012, 17 pages.

(56) **References Cited**

OTHER PUBLICATIONS

Miller, "MOGA gaming controller enhances the Android gaming experience", Retrieved from <http://www.zdnet.com/moga-gaming-controller-enhances-the-android-gaming-experience-7000007550/> on Nov. 20, 2012, Nov. 18, 2012, 9 pages.

Morookian, et al., "Ambient-Light-Canceling Camera Using Subtraction of Frames", NASA Tech Briefs, Retrieved from <http://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20110016693_2011017808.pdf>, May 2004, 2 pages.

Nakanishi, et al., "Movable Cameras Enhance Social Telepresence in Media Spaces", In Proceedings of the 27th International Conference on Human Factors in Computing Systems, retrieved from <http://smg.ams.eng.osaka-u.ac.jp/~nakanishi/hnp_2009_chi.pdf> on Jun. 1, 2012, Apr. 6, 2009, 10 pages.

"Visual and Optometric Issues with Head-Mounted Displays", IS & T/OSA Optics & Imaging in the Information Age, The Society for Imaging Science and Technology, available at <http://www.u.arizona.edu/~zrui3/zhang_pHMPD_spie07.pdf>, 1996, pp. 364-369.

"Applying Solventless Elastomeric Polyurethanes on Concrete in Wastewater Service", In Proceedings: Journal of Protective Coatings and Linings, May 1995, 13 pages.

Reilink, et al., "Endoscopic Camera Control by Head Movements for Thoracic Surgery", In Proceedings of 3rd IEEE RAS & EMBS International Conference of Biomedical Robotics and Biomechatronics, retrieved from <http://doc.utwente.nl/74929/1/biorob_online.pdf> on Jun. 1, 2012, Sep. 26, 2010, pp. 510-515.

Reisman, et al., "A Screen-Space Formulation for 2D and 3D Direct Manipulation", In the proceedings of the 22nd annual ACM symposium on User interface, Retrieved from <http://innovis.cpsc.ucalgary.ca/innovis/uploads/Courses/TableTopDetails2009/Reisman2009.pdf>, Oct. 4, 2009, 69-78.

Schoning, et al., "Building Interactive Multi-Touch Surfaces", Journal of Graphics, GPU, and Game Tools, vol. 14, No. 3, available at <http://www.libavg.com/raw-attachment/wiki/Multitouch/Multitouchguide_draft.pdf>, Nov. 2009, pp. 35-55.

Staff "Gametel Android controller turns tablets, phones into portable gaming devices", Retrieved from <http://www.mobiletor.com/2011/11/18/gametel-android-controller-turns-tablets-phones-into-portable-gaming-devices/#> on Nov. 20, 2012, Nov. 18, 2011, 5 pages.

Sundstedt, "Gazing at Games: Using Eye Tracking to Control Virtual Characters", In ACM SIGGRAPH 2010 Courses, retrieved from <http://www.tobii.com/Global/Analysis/Training/EyeTrackAwards/veronica_sundstedt.pdf> on Jun. 1, 2012, Jul. 28, 2010, 85 pages.

Travis, et al., "Collimated Light from a Waveguide for a Display Backlight", Optics Express, 19714, vol. 17, No. 22, retrieved from <http://download.microsoft.com/download/D/2/E/D2E425F8-CF3C-4C71-A4A2-70F9D4081007/OpticsExpressbacklightpaper.pdf> on Oct. 15, 2009, Oct. 15, 2009, 6 pages.

Travis, et al., "Flat Projection for 3-D", In Proceedings of the IEEE, Volume: 94 Issue: 3, Available at < http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=1605201>, Mar. 13, 2006, pp. 539-549.

Travis, et al., "The Design of Backlights for View-Sequential 3D", retrieved from <http://download.microsoft.com/download/D/2/E/D2E425F8-CF3C-4C71-A4A2-70F9D4081007/Backlightforviewsequentialautostereo.docx> on Nov. 1, 2010, 4 pages.

Valli, "Notes on Natural Interaction", retrieved from <http://www.idemployee.id.tue.nl/g.w.m.rauterberg/lecturenotes/valli-2004.pdf> on Jan. 5, 2012, Sep. 2005, 80 pages.

Vaucelle, "Scopemate, A Robotic Microscope!", Architectradure, retrieved from <http://architectradure.blogspot.com/2011/10/at-uist-this-monday-scopemate-robotic.html> on Jun. 6, 2012, Oct. 17, 2011, 2 pages.

Xu, et al., "Hand Gesture Recognition and Virtual Game Control Based on 3D Accelerometer and EMG Sensors", IUI'09, Feb. 8-11, 2009, retrieved from <http://sclab.yonsei.ac.kr/courses/10TPR/10TPR.files/Hand%20Gesture%20Recognition%20and%20Virtual%20Game%20Control%20based%20on%20%203%20accelerometer%20and%20EMG%20sensors.pdf>on Jan. 5, 2012, Feb. 8, 2009, 5 pages.

Xu, et al., "Vision-based Detection of Dynamic Gesture", ICTM'09, Dec. 5-6, 2009, retrieved from <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=5412956> on Jan. 5, 2012, Dec. 5, 2009, pp. 223-226.

Yan, et al., "Edge-Lighting Light Guide Plate Based on Micro-Prism for Liquid Crystal Display", Journal of Display Technology, vol. 5, No. 9, Available at <http://ieeexplore.ieee.org/ielx5/9425/5196834/05196835.pdf?tp=&arnumber=5196835&isnumber=5196834>, Sep. 2009, pp. 355-357.

Yu, et al., "A New Driving Scheme for Reflective Bistable Cholesteric Liquid Crystal Displays", Society for Information Display International Symposium Digest of Technical Papers, Retrieved from <http://www.ee.ust.hk/~eekwok/publications/1997/bcd_sid.pdf>, May 1997, 4 pages.

Zhang, "Design of Head Mounted Displays", Retrieved at <<http://www.optics.arizona.edu/optomech/student%20reports/2007/Design%20of%20ounteddisplays%20Zhang.pdf>>, Dec. 12, 2007, 6 pages.

Zhu, et al., "Keyboard before Head Tracking Depresses User Success in Remote Camera Control", In Proceedings of 12th IFIP TC 13 International Conference on Human-Computer Interaction, Part II, retrieved from <http://csiro.academia.edu/Departments/CSIRO_ICT_Centre/Papers?page=5> on Jun. 1, 2012, Aug. 24, 2009, 14 pages.

"Advisory Action", U.S. Appl. No. 14/199,924, May 28, 2014, 2 pages.

"Corrected Notice of Allowance", U.S. Appl. No. 13/938,930, May 6, 2014, 2 pages.

"Corrected Notice of Allowance", U.S. Appl. No. 13/938,930, Jun. 6, 2014, 2 pages.

"Corrected Notice of Allowance", U.S. Appl. No. 13/939,002, May 22, 2014, 2 pages.

"Corrected Notice of Allowance", U.S. Appl. No. 13/939,002, Jun. 19, 2014, 2 pages.

"Corrected Notice of Allowance", U.S. Appl. No. 13/939,002, May 5, 2014, 2 pages.

"Final Office Action", U.S. Appl. No. 13/653,682, Jun. 11, 2014, 11 pages.

"Final Office Action", U.S. Appl. No. 14/063,912, Apr. 29, 2014, 10 pages.

"Final Office Action", U.S. Appl. No. 14/199,924, May 6, 2014, 5 pages.

"International Search Report and Written Opinion", Application No. PCT/US2014/013928, May 12, 2014, 17 pages.

"Non-Final Office Action", U.S. Appl. No. 13/471,001, Jun. 17, 2014, 23 pages.

"Non-Final Office Action", U.S. Appl. No. 13/471,030, May 15, 2014, 10 pages.

"Non-Final Office Action", U.S. Appl. No. 13/471,054, Jun. 3, 2014, 15 pages.

"Non-Final Office Action", U.S. Appl. No. 13/471,336, May 7, 2014, 17 pages.

"Non-Final Office Action", U.S. Appl. No. 13/492,232, Apr. 30, 2014, 9 pages.

"Non-Final Office Action", U.S. Appl. No. 13/564,520, Jun. 16, 2014, 5 pages.

"Non-Final Office Action", U.S. Appl. No. 13/595,700, Jun. 18, 2014, 8 pages.

"Non-Final Office Action", U.S. Appl. No. 13/651,976, Jun. 16, 2014, 23 pages.

"Non-Final Office Action", U.S. Appl. No. 14/225,250, Jun. 17, 2014, 5 pages.

"Non-Final Office Action", U.S. Appl. No. 14/225,276, Jun. 13, 2014, 6 pages.

"Non-Final Office Action", U.S. Appl. No. 14/277,240, Jun. 13, 2014, 6 pages.

"Notice of Allowance", U.S. Appl. No. 13/468,918, Jun. 17, 2014, 5 pages.

"Notice of Allowance", U.S. Appl. No. 13/471,237, May 12, 2014, 8 pages.

(56) **References Cited**

OTHER PUBLICATIONS

"Notice of Allowance", U.S. Appl. No. 13/651,232, Apr. 25, 2014, 9 pages.
"Notice of Allowance", U.S. Appl. No. 14/018,286, May 23, 2014, 8 pages.
"Notice of Allowance", U.S. Appl. No. 14/199,924, Jun. 10, 2014, 4 pages.
"Restriction Requirement", U.S. Appl. No. 13/595,700, May 28, 2014, 6 pages.
"Supplemental Notice of Allowance", U.S. Appl. No. 14/018,286, Jun. 11, 2014, 5 pages.

* cited by examiner

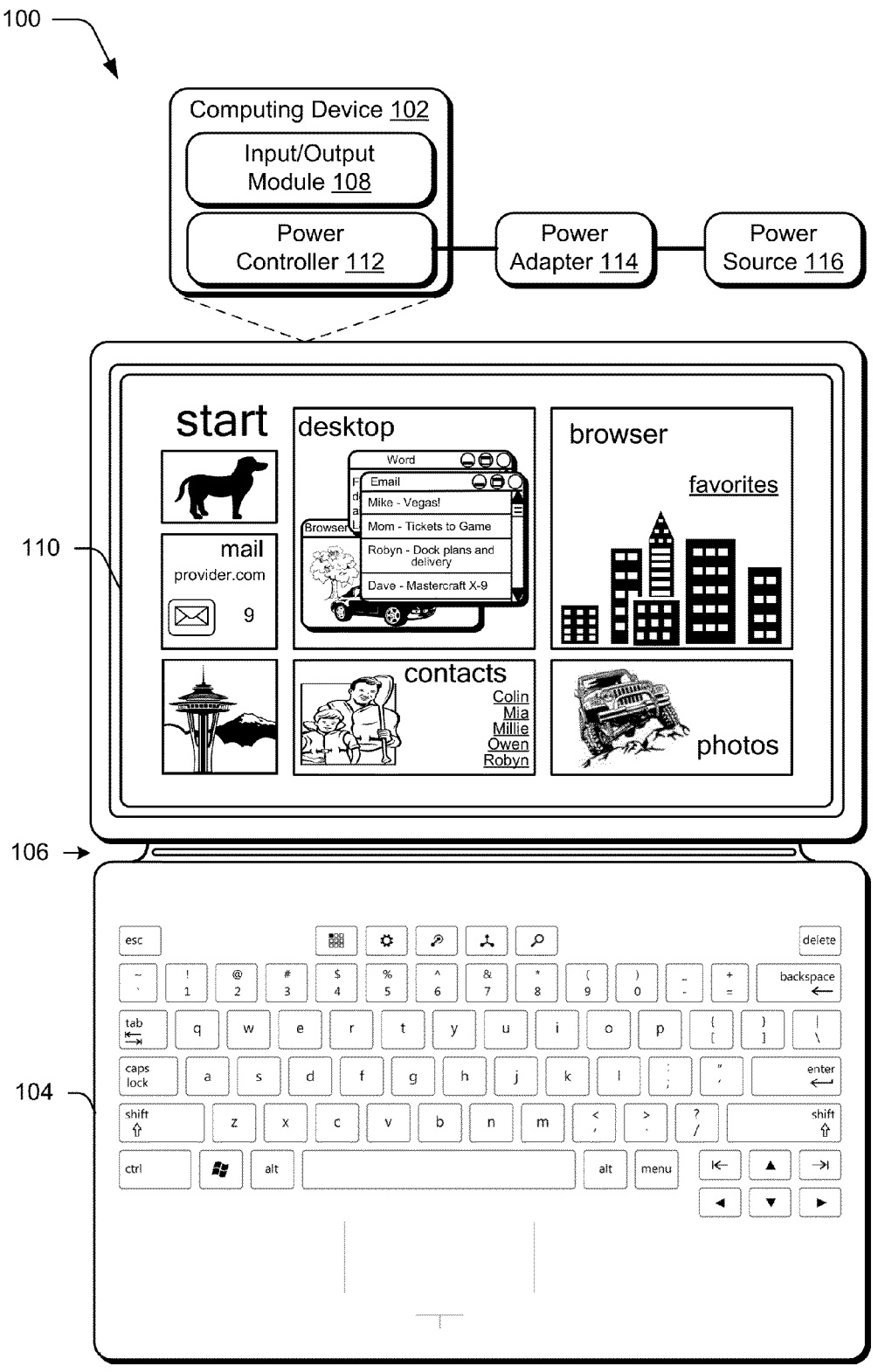

100
Computing Device 102
Input/Output Module 108
Power Controller 112
Power Adapter 114
Power Source 116
110
start
mail
provider.com
9
desktop
Word
Email
Mike - Vegas!
Mom - Tickets to Game
Robyn - Dock plans and delivery
Dave - Mastercraft X-9
Browser
browser
favorites
contacts
Colin
Mia
Millie
Owen
Robyn
photos
106
104
esc
delete
backspace
tab
caps lock
enter
shift
ctrl
alt
menu

Fig. 1

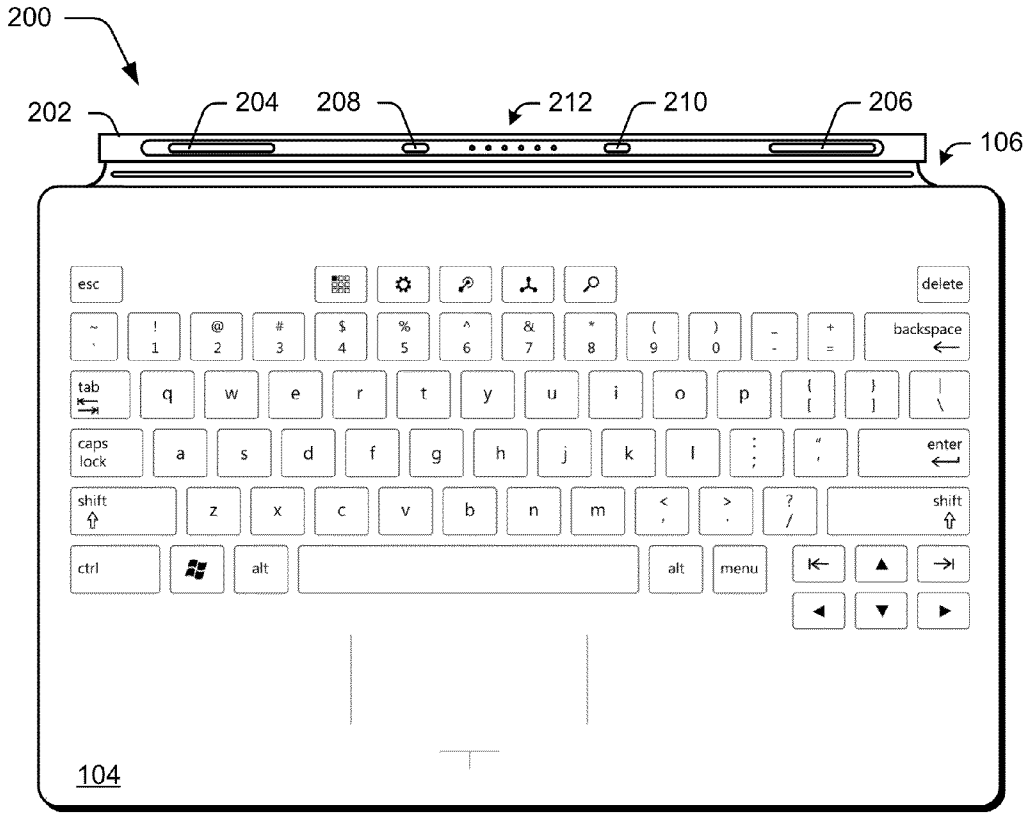

200
202
204
208
212
210
206
106
esc
delete
backspace
tab
q
w
e
r
t
y
u
i
o
p
caps lock
a
s
d
f
g
h
j
k
l
enter
shift
z
x
c
v
b
n
m
shift
ctrl
alt
alt
menu
104

Fig. 2

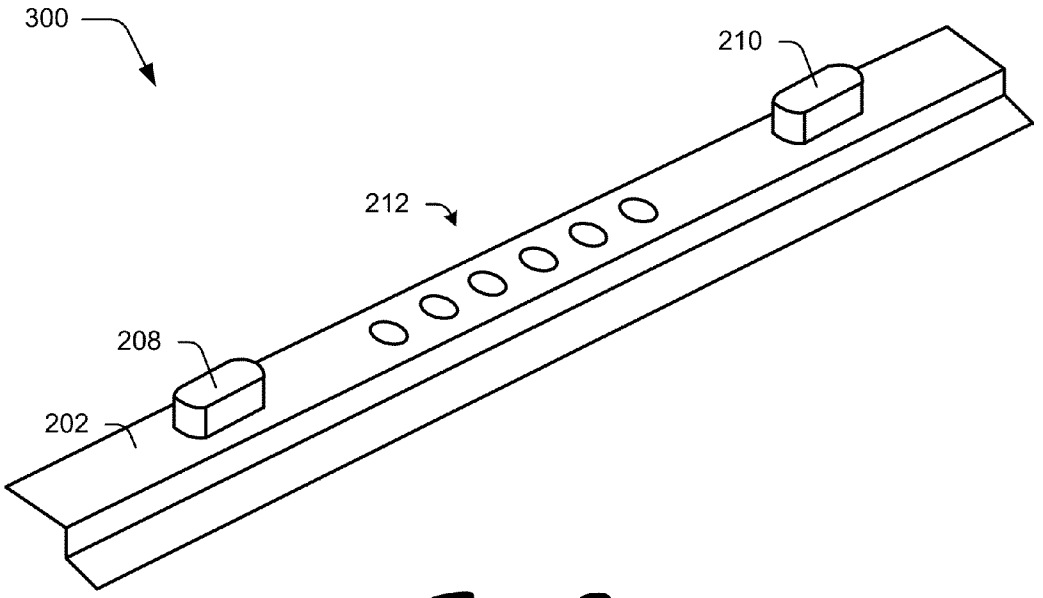

300
210
212
208
202

Fig. 3

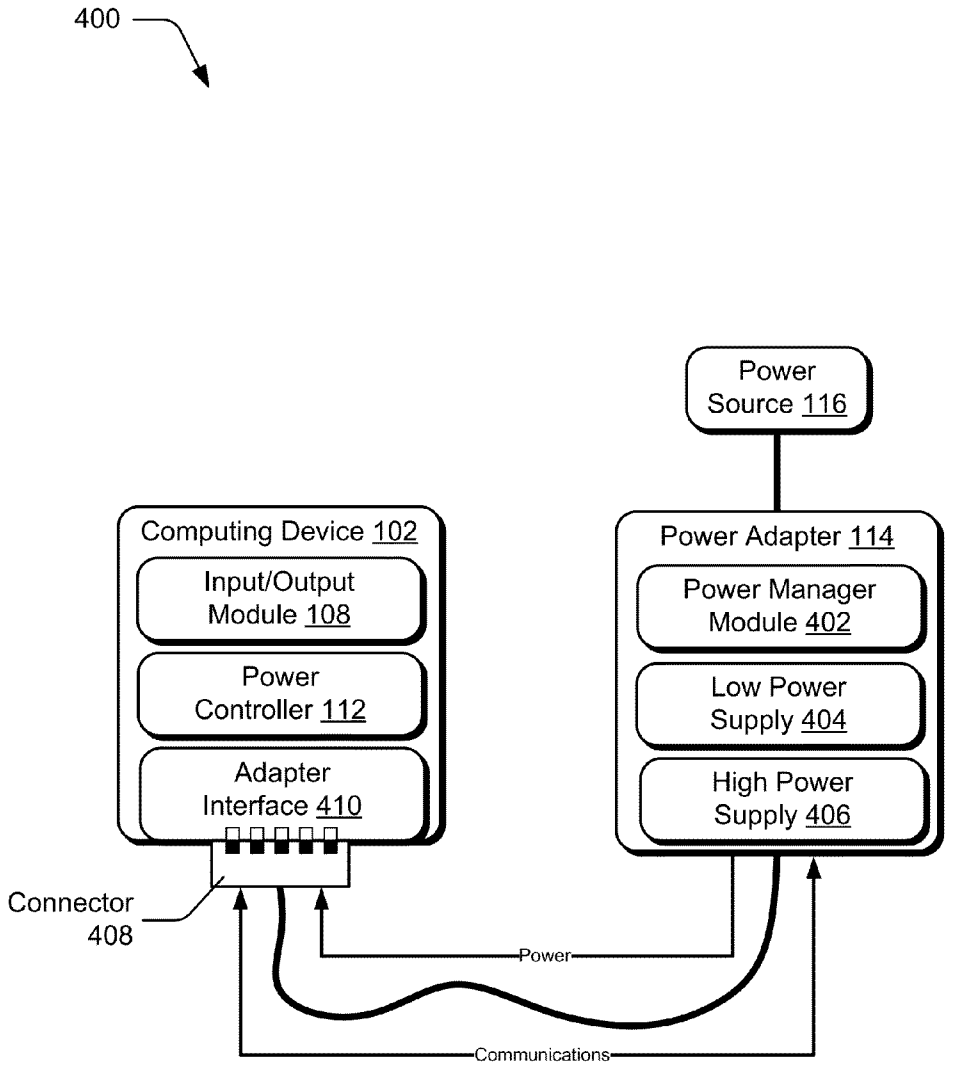

400
Power Source 116
Computing Device 102
Input/Output Module 108
Power Controller 112
Adapter Interface 410
Power Adapter 114
Power Manager Module 402
Low Power Supply 404
High Power Supply 406
Connector 408
Power
Communications

Fig. 4

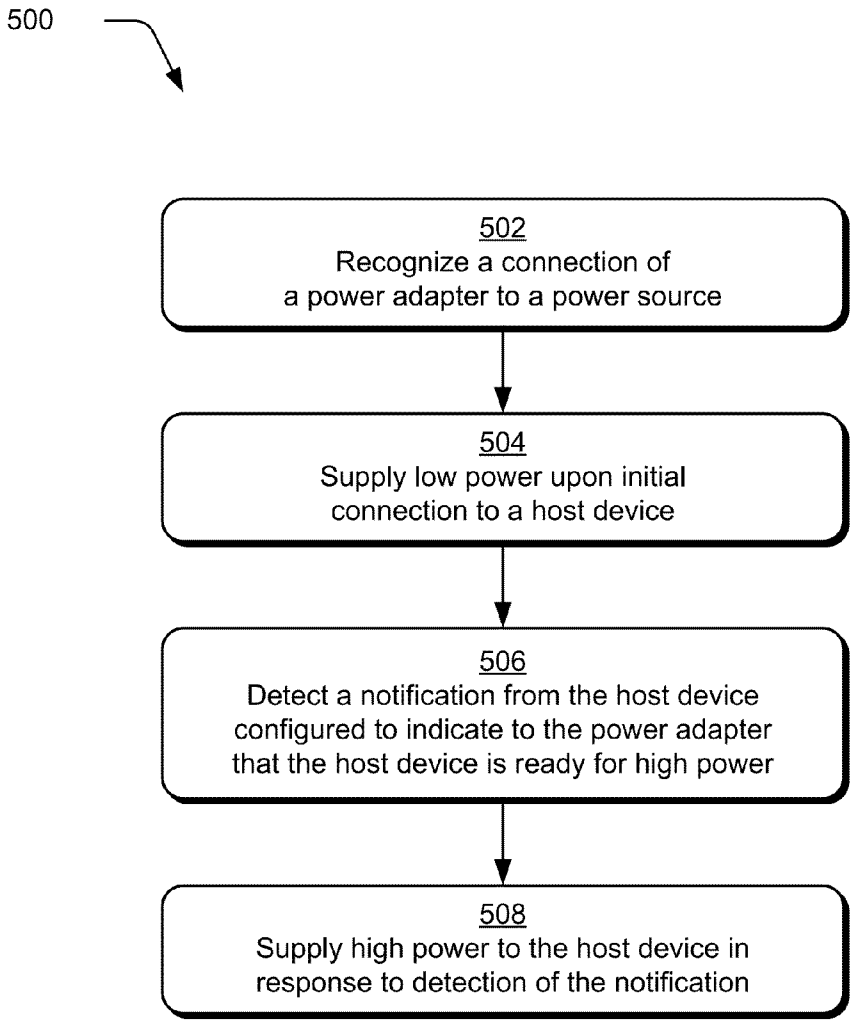

500
502
Recognize a connection of a power adapter to a power source
504
Supply low power upon initial connection to a host device
506
Detect a notification from the host device configured to indicate to the power adapter that the host device is ready for high power
508
Supply high power to the host device in response to detection of the notification

Fig. 5

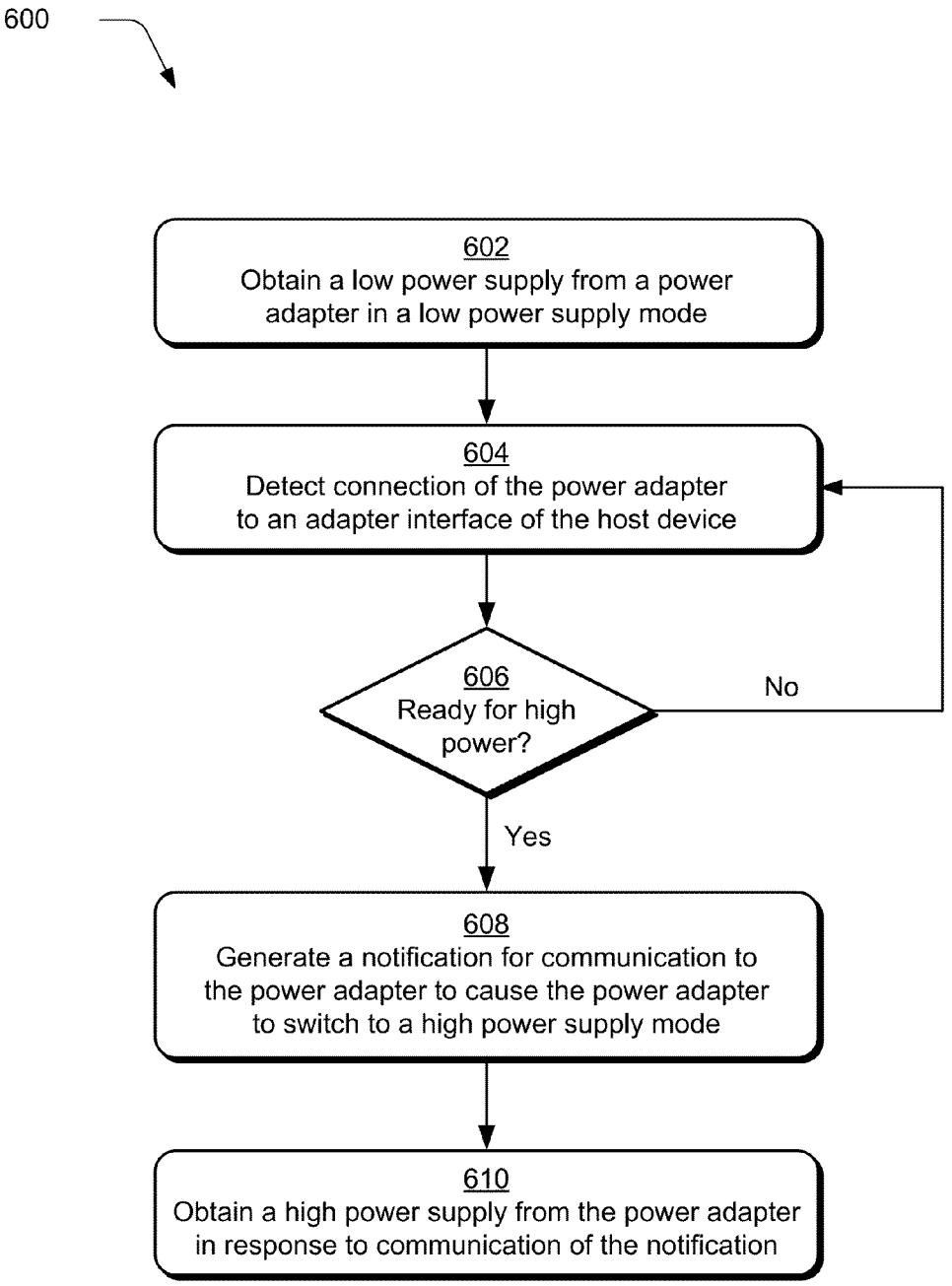

600
602
Obtain a low power supply from a power adapter in a low power supply mode
604
Detect connection of the power adapter to an adapter interface of the host device
606
Ready for high power?
No
Yes
608
Generate a notification for communication to the power adapter to cause the power adapter to switch to a high power supply mode
610
Obtain a high power supply from the power adapter in response to communication of the notification

Fig. 6

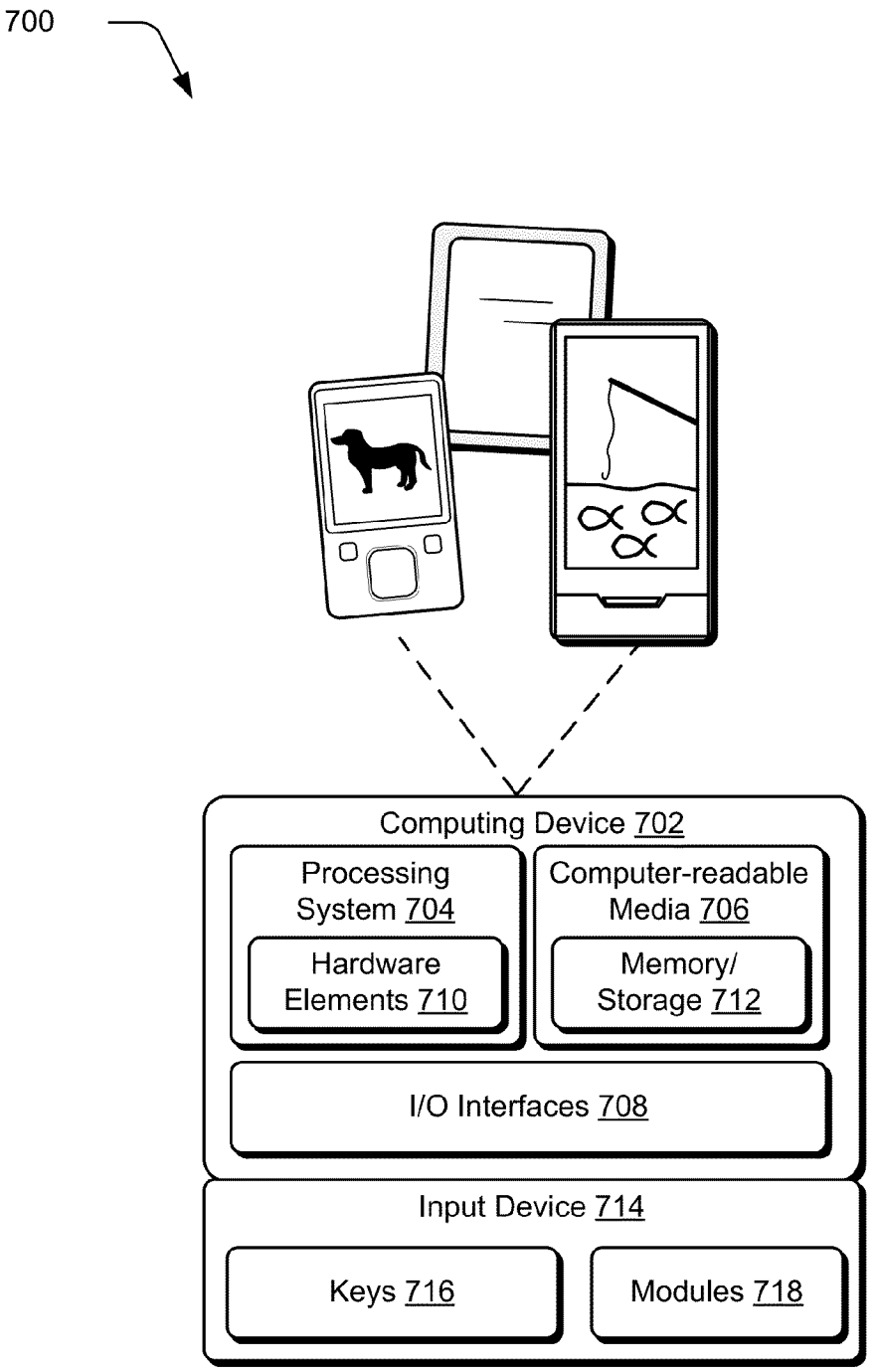

700
Computing Device 702
Processing System 704
Hardware Elements 710
Computer-readable Media 706
Memory/ Storage 712
I/O Interfaces 708
Input Device 714
Keys 716
Modules 718

Fig. 7

# MULTI-STAGE POWER ADAPTER CONFIGURED TO PROVIDE LOW POWER UPON INITIAL CONNECTION OF THE POWER ADAPTER TO THE HOST DEVICE AND HIGH POWER THEREAFTER UPON NOTIFICATION FROM THE HOST DEVICE TO THE POWER ADAPTER

## RELATED APPLICATIONS

This application is a continuation of and claims priority to U.S. patent application Ser. No. 13/471,412, filed May 14, 2012, entitled "Multi-Stage Power Adapter" and further claims priority under 35 U.S.C. §119(e) to the following U.S. Provisional patent applications, the entire disclosures of each of these applications being incorporated by reference in their entirety:

U.S. Provisional Patent Application No. 61/606,333, filed Mar. 2, 2012, and titled "Usage and Authentication;"

U.S. Provisional Patent Application No. 61/613,745, filed Mar. 21, 2012, and titled "Usage and Authentication;" and

U.S. Provisional Patent Application No. 61/607,451, filed Mar. 6, 2012, and titled "Spanaway Provisional."

## BACKGROUND

Mobile computing devices have been developed to increase the functionality that is made available to users in a mobile setting. For example, a user may interact with a mobile phone, tablet computer, or other mobile computing device to check email, surf the web, compose texts, interact with applications, and so on. One challenge that faces developers of mobile computing devices is efficient power management and extension of battery life. For instance, the small form factor of many mobile computing devices may compel designs in which power connections are kept relatively small in size. Accordingly, developers may be further concerned with ensuring that adapters designed for use with such small form power connections are safe and supply the proper amount of power to the device.

## SUMMARY

Multi-stage power adapter techniques are described. In one or more embodiments, a power adapter for a device is configured to selectively switch between a relatively low power supply and a relatively high power supply. The low power supply may be employed upon initial connection of the adapter to a host device to ensure that the adapter is safe when disconnected and does not supply full power before the device is ready to receive the high power supply. The low power supply may supply enough power for the host device to detect the connection of the adapter and establish initial communication with the adapter. A switch to the high power supply by the adapter may then occur in response to a notification from the host device that indicates the host device is ready for the high power supply. The switch to high power supply enables normal operation of the host device.

This Summary is provided to introduce a selection of concepts in a simplified form that are further described below in the Detailed Description. This Summary is not intended to identify key features or essential features of the claimed subject matter, nor is it intended to be used as an aid in determining the scope of the claimed subject matter.

## BRIEF DESCRIPTION OF THE DRAWINGS

The detailed description is described with reference to the accompanying figures. In the figures, the left-most digit(s) of a reference number identifies the figure in which the reference number first appears. The use of the same reference numbers in different instances in the description and the figures may indicate similar or identical items. Entities represented in the figures may be indicative of one or more entities and thus reference may be made interchangeably to single or plural forms of the entities in the discussion.



FIG. **1** is an illustration of an environment in an example implementation that is operable to employ the techniques described herein.

FIG. **2** depicts an example implementation of an input device of FIG. **1** as showing a flexible hinge in greater detail.

FIG. **3** depicts an example implementation showing a perspective view of a connecting portion of FIG. **2** that includes mechanical coupling protrusions and a plurality of communication contacts.

FIG. **4** depicts an example power adapter for the computing device of FIG. **1** in greater detail.

FIG. **5** depicts an example procedure in accordance with one or more embodiments.

FIG. **6** depicts another example procedure in accordance with one or more embodiments.

FIG. **7** illustrates an example system including various components of an example device that can be implemented as any type of computing device to implement embodiments of the techniques described herein.

## DETAILED DESCRIPTION

### Overview

Ensuring that adapters designed for use with such small form power connections of modern host devices are safe and supply the proper amount of power to the device can present challenges. For instance, traditional adapters that supply a constant power level may be dangerous and susceptible to shorting out if exposed connections are contacted inadvertently by a user or object other than the corresponding host device.

Multi-stage power adapter techniques are described in which a power adapter for a device is configured to selectively switch between a relatively low power supply and a relatively high power supply. The low power supply may be employed upon initial connection of the adapter to a host device to ensure that the adapter is safe when disconnected and does not supply full power before the device is ready to receive the high power supply. The low power supply may supply enough power for the host device to detect the connection of the adapter and establish initial communication with the adapter. A switch to the high power supply by the adapter may then occur in response to a notification from the host device that indicates the host device is ready for the high power supply. The switch to high power supply enables "normal" operations of the host device.

In the following discussion, an example environment is first described that may employ the techniques described herein. Example procedures are then described which may be performed in the example environment as well as other environments. Consequently, performance of the example procedures is not limited to the example environment and the example environment is not limited to performance of the example procedures.

### Example Operating Environment

FIG. **1** is an illustration of an environment **100** in an example implementation that is operable to employ the techniques described herein. The illustrated environment **100** includes an example of a computing device **102** that is physically and communicatively coupled to an input device **104** via

a flexible hinge **106**. The computing device **102** may be configured in a variety of ways. For example, the computing device **102** may be configured for mobile use, such as a mobile phone, a tablet computer as illustrated, and so on. Thus, the computing device **102** may range from full resource devices with substantial memory and processor resources to a low-resource device with limited memory and/or processing resources. The computing device **102** may also relate to software that causes the computing device **102** to perform one or more operations.

The computing device **102**, for instance, is illustrated as including an input/output module **108**. The input/output module **108** is representative of functionality relating to processing of inputs and rendering outputs of the computing device **102**. A variety of different inputs may be processed by the input/output module **108**, such as inputs relating to functions that correspond to keys of the input device, keys of a virtual keyboard displayed by the display device **110** to identify gestures and cause operations to be performed that correspond to the gestures that may be recognized through the input device **104** and/or touchscreen functionality of the display device **110**, and so forth. Thus, the input/output module **108** may support a variety of different input techniques by recognizing and leveraging a division between types of inputs including key presses, gestures, and so on.

In the illustrated example, the input device **104** is configured as a keyboard having a QWERTY arrangement of keys although other arrangements of keys are also contemplated. Further, other non-conventional configurations are also contemplated, such as a game controller, configuration to mimic a musical instrument, and so forth. Thus, the input device **104** and keys incorporated by the input device **104** may assume a variety of different configurations to support a variety of different functionality.

As previously described, the input device **104** is physically and communicatively coupled to the computing device **102** in this example through use of a flexible hinge **106**. The flexible hinge **106** is flexible in that rotational movement supported by the hinge is achieved through flexing (e.g., bending) of the material forming the hinge as opposed to mechanical rotation as supported by a pin, although that embodiment is also contemplated. Further, this flexible rotation may be configured to support movement in one direction (e.g., vertically in the figure) yet restrict movement in other directions, such as lateral movement of the input device **104** in relation to the computing device **102**. This may be used to support consistent alignment of the input device **104** in relation to the computing device **102**, such as to align sensors used to change power states, application states, and so on.

The flexible hinge **106**, for instance, may be formed using one or more layers of fabric and include conductors formed as flexible traces to communicatively couple the input device **104** to the computing device **102** and vice versa. This communication, for instance, may be used to communicate a result of a key press to the computing device **102**, receive power from the computing device, perform authentication, provide supplemental power to the computing device **102**, and so on. The flexible hinge **106** may be configured in a variety of ways, further discussion of which may be found in relation to the following figure.

As further illustrated in FIG. **1** the computing device **102** may include a power controller **112** that implements aspects of multi-stage power adapter techniques described herein. The power controller **112** represents functionality of the computing device to perform various operations for power management. This may include management of different power sources and switching between the sources, implementing a defined and/or selected power management scheme, managing battery life, and so forth. The power controller **112** may also facilitate connections and communications with a power adapter **114** configured to supply power to the device via a suitable power source **116**, such as a wall socket, external battery, or other external source of power. The power controller **112** may be implemented in hardware, software, firmware and/or combinations thereof. By way of example and not limitation, the computing device **102** may include a microcontroller or other suitable hardware logic device configured to implement various functionally that is described herein in relation to power controller **112**. In addition or alternatively, the power controller **112** may be implemented by way of a processing system of the device and one or more program modules that are executable/operable via the processing system. Further description of example implementations suitable for the power controller **112** and other described modules/functionality can be found below in relation to the discussion of an example computing device depicted in FIG. **7**.

The power adapter **114** may be configured to selectively operate in multiple modes and supply multiple power levels to the computing device. The level of power supplied at a particular time may be based upon input, notifications, or other suitable feedback configured and sent to the power adapter **114** by the power controller **112** to cause the power adapter **114** to supply a corresponding level of power. Further details regarding operation of the power controller **112** and the power adapter **114** to implement multi-stage power adapter techniques can be found in the following discussion.

FIG. **2** depicts an example implementation **200** of the input device **104** of FIG. **1** as showing the flexible hinge **106** in greater detail. In this example, a connection portion **202** of the input device is shown that is configured to provide a communicative and physical connection between the input device **104** and the computing device **102**. In this example, the connection portion **202** has a height and cross section configured to be received in a channel in the housing of the computing device **102**, although this arrangement may also be reversed without departing from the spirit and scope thereof.

The connection portion **202** is flexibly connected to a portion of the input device **104** that includes the keys through use of the flexible hinge **106**. Thus, when the connection portion **202** is physically connected to the computing device the combination of the connection portion **202** and the flexible hinge **106** supports movement of the input device **104** in relation to the computing device **102** that is similar to a hinge of a book.

For example, rotational movement may be supported by the flexible hinge **106** such that the input device **104** may be placed against the display device **110** of the computing device **102** and thereby act as a cover. The input device **104** may also be rotated so as to be disposed against a back of the computing device **102**, e.g., against a rear housing of the computing device **102** that is disposed opposite the display device **110** on the computing device **102**.

Naturally, a variety of other orientations are also supported. For instance, the computing device **102** and input device **104** may assume an arrangement such that both are laid flat against a surface as shown in FIG. **1**. In another instance, a typing arrangement may be supported in which the input device **104** is laid flat against a surface and the computing device **102** is disposed at an angle to permit viewing of the display device **110**, e.g., such as through use of a kickstand disposed on a rear surface of the computing device **102**. Other

instances are also contemplated, such as a tripod arrangement, meeting arrangement, presentation arrangement, and so forth.

The connecting portion **202** is illustrated in this example as including magnetic coupling devices **204**, **206**, mechanical coupling protrusions **208**, **210**, and a plurality of communication contacts **212**. The magnetic coupling devices **204**, **206** are configured to magnetically couple to complementary magnetic coupling devices of the computing device **102** through use of one or more magnets. In this way, the input device **104** may be physically secured to the computing device **102** through use of magnetic attraction.

The connecting portion **202** also includes mechanical coupling protrusions **208**, **210** to form a mechanical physical connection between the input device **104** and the computing device **102**. The mechanical coupling protrusions **208**, **210** are shown in greater detail in the following figure.

FIG. **3** depicts an example implementation **300** shown a perspective view of the connecting portion **202** of FIG. **2** that includes the mechanical coupling protrusions **208**, **210** and the plurality of communication contacts **212**. As illustrated, the mechanical coupling protrusions **208**, **210** are configured to extend away from a surface of the connecting portion **202**, which in this case is perpendicular although other angles are also contemplated.

The mechanical coupling protrusions **208**, **210** are configured to be received within complimentary cavities within the channel of the computing device **102**. When so received, the mechanical coupling protrusions **208**, **210** promote a mechanical binding between the devices when forces are applied that are not aligned with an axis that is defined as correspond to the height of the protrusions and the depth of the cavity.

For example, when a force is applied that does coincide with the longitudinal axis described previously that follows the height of the protrusions and the depth of the cavities, a user overcomes the force applied by the magnets solely to separate the input device **104** from the computing device **102**. However, at other angles the mechanical coupling protrusion **208**, **210** are configured to mechanically bind within the cavities, thereby creating a force to resist removal of the input device **104** from the computing device **102** in addition to the magnetic force of the magnetic coupling devices **204**, **206**. In this way, the mechanical coupling protrusions **208**, **210** may bias the removal of the input device **104** from the computing device **102** to mimic tearing a page from a book and restrict other attempts to separate the devices.

The connecting portion **202** is also illustrated as including a plurality of communication contacts **212**. The plurality of communication contacts **212** is configured to contact corresponding communication contacts of the computing device **102** to form a communicative coupling between the devices. The communication contacts **212** may be configured in a variety of ways, such as through formation using a plurality of spring loaded pins that are configured to provide a consistent communication contact between the input device **104** and the computing device **102**. Therefore, the communication contact may be configured to remain during minor movement or jostling of the devices. A variety of other examples are also contemplated, including placement of the pins on the computing device **102** and contacts on the input device **104**. In at least some embodiments, the power adapter **114** may be configured as an input device **104** that is connectable to the computing device **102** via the connecting portion **202** and/or communication contacts **212** just described. In addition or alternatively, the power adapter **114** may employ a power supply connection/adapter interface that is dedicated for use by external power adapters and/or is provided separately from the described connecting portion **202** and/or communication contacts **212**. Additional details regarding suitable power adapter connections and configurations are provided in relation to the following figures.

In particular, FIG. **4** depicts generally at **400** an example power adapter **114** in greater detail. In the depicted example, the power adapter is illustrated as including a power manager module **402** that represents functionality to manage power supplied by the adapter in various ways. For example, the power manager module **402** may be configured to manage communications with a computing device **102** and control the level of power supplied to the computing device accordingly. This may include selectively switching between at least a low power supply **404** and a high power supply **406**. The power manager module **402** may be implemented as a component of the power adapter **114** in hardware, software, firmware, and/or a combination thereof. In one embodiment, functionality described in relation to the power manager module **402** is provided by way of microcontroller device or other suitable hardware/logic device integrated with the power adapter **114**. A variety of other arrangements are also contemplated.

The low power supply **404** and high power supply **406** represent any suitable combination of hardware, software, circuitry, and/or logic that can be configured to provide different selected power levels to a device from a power source **116** (e.g., a wall socket, battery, or other source) to which the example power adapter **114** is connected. By way of example and not limitation, the power adapter may be configured to supply a nominal twelve volt power supply with current being varied to implement different power modes corresponding to different power levels. To enable a low power mode, the power manager module **402** may limit current to a relatively small value so that to low power supply **404** is safe when disconnected and/or when connector pins are contacted by a user or object. For example, the current in the low power mode may be limited in the range of approximately 20-30 milliamps. This power level provides enough power for operations of the power manager module **402**/microcontroller device and is otherwise a relatively safe level of output if unintentional contacts and/or shorts of the power adapter occur. Then, in response to appropriate input/feedback from a host device, the power manager module **402** may remove or change the current limit to enable a high power mode for the high power supply **406** and more power intensive operations of the host device. Although two power modes/levels are shown by way of example, a power adapter may be configured to provide and switch between multiple (e.g., two or more) different modes and power levels. Thus, in some embodiments more than two modes/levels may be available.

In one approach, the low power supply **404** and high power supply **406** may be implemented by selectively changing/switching the amount of resistance applied in power supply circuitry of the power adapter. Under substantially constant voltage conditions (e.g., approximately twelve volts), switching the resistance results in a change in the amount of current supplied by the power adapter. Relatively higher resistance is employed for low power mode to limit the current to a safe level. The power manager module **402** may then operate to switch the power supply circuitry to high power mode by removing or reducing the resistance. The change in resistance may occur by isolating a portion of the circuitry, toggling switches to switch between multiple different circuits, or otherwise controlling the amount of resistance to implement multiple power modes.

As further shown in FIG. **4**, the power adapter **114** may include or otherwise make use of a connector **408** that is

configured to connect the power adapter to the computing device **102** via a corresponding adapter interface **410**. The connection of the connector **408** and adapter interface **410** provides both a power coupling for supplying power from the adapter to the device and a communicative coupling to carry communications between the adapter and device. The connector **408** and adapter interface **410** may be configured in various ways to establish a suitable connection between the device and adapter. By way of example and not limitation, the example connector **408** of FIG. **4** is depicted as having five pins that create a connection by contact with five corresponding pins of the adapter interface **410**. In this arrangement, two pins of the connection may be used for positive voltage, another two pins may be used for voltage return, and the remaining pin of the connection may establish a single pin communication line/channel used to convey communications between the adapter and device. A variety of other arrangements are also contemplated.

The power manager module **402** may be implemented in various ways to selectively switch between the low power supply **404** and high power supply **406** at the direction of the computing device **102**. In general, the power manager module **402** is configured to recognize notifications or other suitable feedback communicated by a computing device that is indicative of a state of the device and/or a corresponding power level to supply to the device. In one approach, the low power supply **404** is employed by the power adapter **114** initially upon connection to the power source. This may occur both when the power adapter **114** is disconnected from the computing device **102** and when the power adapter **114** is connected to the computing device **102**. Thus, a "safe" level of power may be supplied at select times including when the adapter in not connected to the appropriate adapter interface **410**, when initially connected to a device, and/or when the device is otherwise not ready for full power (e.g., upon waking from a sleep/hibernate mode, loose connector, etc.). The power manager module **402** may then continue to operate the power adapter **114** using the low power supply **404** until a notification or other suitable feedback from the device is obtained that indicates the computing device **102** is ready to accept the high power supply **406**.

The low power supply **404** provides power sufficient to enable the computing device **102** to at least recognize a connection to the power supply and perform some basic operations such as to charge a battery of the device, establish communication with the power adapter, initialize the device, run a microcontroller that implements functionality of the power controller **112**, and so forth. In other words, the low power supply **404** provides enough power for a subset of the full device functionality. For instance, the low power supply **404** enables operation of the power controller **112** of the computing device to perform power management tasks including generating notifications/feedback for communication to the power adapter **114** at appropriate times. The power controller **112** may operate using relatively low power, independently of operating a "primary" processing system (for example, one or more central processing units of the device) of the host computing device, and/or without booting/executing an operating system or using other device components and applications. In other words, the power controller **112** may operate to perform some power management tasks without having to operate or supply power to the processing system and other device components (e.g., device memory, network interface, display device, etc.) and/or without completely starting-up or waking-up the computing device.

In particular, the power controller **112** may recognize coupling of the connector **408** to the adapter interface **410** when a user inserts or otherwise connects/attaches the adapter to the device and/or during an initial boot sequence after a shutdown, a period on inactivity, or waking up from a sleep/hibernate mode. The power controller **112** may further perform one or more checks to ensure the computing device is ready for full power, which may include testing the connection to the connector **408**, ascertaining a device state for the computing device, making sure that a device battery is charged to a threshold level for device operations, identifying the adapter, verifying that voltage output and/or other characteristics of the adapter are valid, and so forth. Based on these and/or other tests, the power controller **112** determines whether or not the computing device is ready for the high power supply **406**.

When the power controller **112** determines that the device is ready for switching to full power, the power controller **112** generates feedback and communicates the feedback to the power adapter **114** via the communication channel/line to cause a switch between power modes. In response to suitable feedback, the power manager module **402** may then cause a switch from the low power supply **404** to the high power supply **406**. The high power supply is sufficient to enable "normal" device operations such as booting an operating system, running a primary processing system of the device, executing applications, establishing network connections, polling for messages/notifications, and so forth.

The feedback generated and communicated by the power controller **112** may be configured in various ways. Generally speaking, the power controller **112** may generate a notification or signal that is recognizable by the power adapter and in particular the power manager module **402**. For instance, the power controller **112** may generate and send an alphanumeric code, a repeating signal pattern, a notification message, a binary value, or other feedback suitable to convey information regarding whether or not the computing device is ready for the high power supply **406**. Alternatively, the feedback may indicate a particular selected power mode/level from multiple (e.g., two or more) available levels. When the feedback/pattern is being sent by the power controller **112**, the power adapter **114** may recognize this and switch to high power mode. When the feedback/pattern is absent or concludes, the power adapter may continue to operate in low power mode or if currently operating in high power mode, switch back to the low power mode. The feedback/pattern may discontinue for example if the connector **408** is detached or if the host device is shutdown.

In one particular example, the feedback/notification is in the form of a patterned signal that is produced by the power controller **112** and communicated to the power adapter **114** via the communicative coupling established through attachment of the connector **408** to the adapter interface **410**. A variety of different patterned signals are contemplated. The patterned signal is configured to use a non-random format that is expected by the power manager module **402** and generally prevents the power manager module **402** from recognizing random inputs that may be inadvertently generated. By way of example, the pulsed signal may be configured as a repeating pattern of voltage pulses that vary from zero to a peak value at a designated periodic time interval. One suitable example of a pulsed signal that may be employed by the power controller **112** produces a pattern having a peak voltage of 3.3 volts for five milliseconds that repeats every one hundred milliseconds. Naturally, various other periodic voltage patterns and other types of repeating patterns may also be employed.

Having considered the preceding discussion of an example operating environment and devices, consider now a discus-

sion of some example procedures which includes further implementation details regarding the example devices techniques for a multi-stage power adapter.

Example Procedures

The following discussion describes multi-stage power adapter techniques that may be implemented utilizing the previously described systems and devices. Aspects of each of the procedures may be implemented in hardware, firmware, software, or a combination thereof. The procedures are shown as a set of blocks that specify operations performed by one or more devices and are not necessarily limited to the orders shown for performing the operations by the respective blocks. In portions of the following discussion, reference may be made to the example operating environment **100** of FIG. **1** and the example devices of FIGS. **2-4**, respectively.

FIG. **5** depicts an example procedure **500** in which a power level supplied by an adapter is selectively switched. In at least some embodiments, the procedure may be performed by a suitably configured power adapter, such as the example power adapter **114** of FIG. **4** that includes or otherwise make use of a power manager module **402**.

An initial connection of a power adapter to a power source is recognized (block **502**). For example, a power manager module **402** implemented by a power adapter **114** may recognize when the power adapter **114** is connected to a power source **116**, such as when a user plugs the adapter into a wall socket. The power manager module **402** may cause the power adapter **114** to initially operate in a low power mode. For example, the power manager module **402** may set power supply circuitry of the power adapter **114** to limit current by selecting relatively high resistance as described previously or by using other suitable techniques to select a low power mode.

Low power is supplied upon the initial connection to the host device (block **504**). For instance, a user may attach the power adapter **114** to host device, such as by plugging the connector **408** into the adapter interface **408** of the example computing device **102** illustrated in FIG. **4**. Alternatively, the power adapter **114** may already be attached to the host device when the adapter is connected to the power source **116**. In either case, the power manager module **402** continues to operate the adapter in low power mode upon initial connection to the host device. The connection may establish a communicative coupling between the adapter and the host device as describe previously. When the adapter is connected, the power manager module **402** may monitor this communication connection to detect notifications or other feedback generated by the power controller **112**.

In particular, a notification is detected from the host device that is configured to indicate to the power adapter that the host device is ready for high power (block **506**) and high power is supplied to the host device in response to detection of the notification (block **508**). Any suitable notification may be employed. For instance, a pulsed signal may be generated via the power controller **112** and communicated over a communication channel/line established between the host device and adapter as described in the preceding discussion. The power controller **112** may generate the pulsed signal in response to a determination that the host device is ready for high power. The determination may be made based in part upon various tests including at least making sure that the adapter is attached properly and/or that the adapter is capable of supplying power in an acceptable range.

The power manager module **402** may be configured to detect suitably configured notifications, such as a pulsed signal that is in an expected format. In response to detecting an appropriate notification, signal, or other feedback, the power manager module **402** may cause a switch from the low power mode to a high power mode in which high power is supplied, or otherwise switch between multiple available power modes. As mentioned, this may involve selectively operating and/or switching circuitry of the adapter to toggle between different power modes.

FIG. **6** depicts an example procedure **600** in which a device communicates a notification to cause an adapter to switch between power supply modes. In at least some embodiments, the procedure may be performed by a suitably configured computing device, such as the example computing device **102** of FIG. **4** that includes or otherwise make use of a power controller **112**. A low power supply is obtained from the power adapter in a low power mode (block **602**) and connection of a power adapter to an adapter interface of a host device is detected (block **604**). For example, initially upon connection to a host device a power adapter may supply low power as previously discussed. A power controller **112** may be configured to detect connection of the adapter in various scenarios and perform corresponding power management operations.

For example, if the host device is operating on internal battery power, the power controller **112** may initiate operations to switch to power supplied by the adapter and/or to charge the battery if appropriate. The power controller **112** may also detect an attached adapter when waking up from a sleep mode or hibernation state. In yet another scenario, the host device may have run out of internal battery power and therefore may be completely shut down. Low power supplied by the power adapter, though, is sufficient to enable operation of the power controller **112** to start-up and perform designated power management operations, including at least controlling selection of modes for multi-stage power adapter techniques described above and below. In each of these scenarios, the multi-stage power adapter may operate in low power mode until the power adapter is notified by the host device to switch to high power mode and supply high power for normal device operations.

In particular, a determination is made regarding whether the host device is ready for a high power supply (block **606**). The determination may be made by the power controller **112** based on one or more tests as described above. When the device is ready, a notification is generated for communication to the power adapter to cause the power adapter to switch to a high power supply mode (block **608**) and the host device obtains high power supply from the power adapter in response to communication of the notification (block **610**). In general, the power controller **112** may generate and communicate a suitable notification after ascertaining that the connection to the adapter is proper and/or that the adapter is configured to supply power output within an acceptable range that is compatible with the host device.

In some embodiments, the power controller **112** may also be configured to identify and distinguish between different adapters based on identifying data obtained from the adapter via the communicative coupling. The identifying data associates an adapter with a particular adapter type. For example, the power controller **112** may obtain and/or read a resistance value of an identification resistor included within circuitry of the power adapter. The resistance value of the identification resistor may be set to different values for different types of adapters so that the power controller **112** may identify the type of adapter that is attached. Based on this identification, the power controller **112** may recognize the capabilities of various different adapters and perform power management operations that correspond to the particular type of adapter that is currently connected. Thus, based on various different checks, the power controller **112** may determine that the host

device is ready to receive high power from the adapter and signal the adapter that the host device is ready. To do so, the power controller **112** generates a suitable notification, which may be configured as a notification message, a binary value or other code, a pulsed signal, and so forth.

On the other hand, when it is determined per block **606** that the device is not ready for high power supply, the host device may continue to obtain the low power supply. In some embodiments, the absence of any notification signals the adapter to continue operating in the low power mode or switch to the low power mode. In some scenarios, though, the power controller **112** may generate different notifications or signals that are indicative of different modes and cause the power adapter to switch to a particular mode that is selected when a corresponding signal is recognized. The determination regarding whether the device is ready may then be repeated until the device is ready or the process is interrupted by some other operation, such as a timeout, shutdown of the host device, disconnection of the adapter and so forth.

Having considered the foregoing example procedures, consider now a discussion of example systems and devices that may be employed to implement aspects of multi-stage power adapter techniques in one or more embodiments.

Example System and Device

FIG. **7** illustrates an example system generally at **700** that includes an example computing device **702** that is representative of one or more computing systems and/or devices that may implement the various techniques described herein. The computing device **702** may be, for example, be configured to assume a mobile configuration through use of a housing formed and size to be grasped and carried by one or more hands of a user, illustrated examples of which include a mobile phone, mobile game and music device, and tablet computer although other examples are also contemplated.

The example computing device **702** as illustrated includes a processing system **704**, one or more computer-readable media **706**, and one or more I/O interface **708** that are communicatively coupled, one to another. Although not shown, the computing device **702** may further include a system bus or other data and command transfer system that couples the various components, one to another. A system bus can include any one or combination of different bus structures, such as a memory bus or memory controller, a peripheral bus, a universal serial bus, and/or a processor or local bus that utilizes any of a variety of bus architectures. A variety of other examples are also contemplated, such as control and data lines.

The processing system **704** is representative of functionality to perform one or more operations using hardware. Accordingly, the processing system **704** is illustrated as including hardware element **710** that may be configured as processors, functional blocks, and so forth. This may include implementation in hardware as an application specific integrated circuit or other logic device formed using one or more semiconductors. The hardware elements **710** are not limited by the materials from which they are formed or the processing mechanisms employed therein. For example, processors may be comprised of semiconductor(s) and/or transistors (e.g., electronic integrated circuits (ICs)). In such a context, processor-executable instructions may be electronically-executable instructions.

The computer-readable storage media **706** is illustrated as including memory/storage **712**. The memory/storage **712** represents memory/storage capacity associated with one or more computer-readable media. The memory/storage component **712** may include volatile media (such as random access memory (RAM)) and/or nonvolatile media (such as read only memory (ROM), Flash memory, optical disks, magnetic disks, and so forth). The memory/storage component **712** may include fixed media (e.g., RAM, ROM, a fixed hard drive, and so on) as well as removable media (e.g., Flash memory, a removable hard drive, an optical disc, and so forth). The computer-readable media **706** may be configured in a variety of other ways as further described below.

Input/output interface(s) **708** are representative of functionality to allow a user to enter commands and information to computing device **702**, and also allow information to be presented to the user and/or other components or devices using various input/output devices. Examples of input devices include a keyboard, a cursor control device (e.g., a mouse), a microphone, a scanner, touch functionality (e.g., capacitive or other sensors that are configured to detect physical touch), a camera (e.g., which may employ visible or non-visible wavelengths such as infrared frequencies to recognize movement as gestures that do not involve touch), and so forth. Examples of output devices include a display device (e.g., a monitor or projector), speakers, a printer, a network card, tactile-response device, and so forth. Thus, the computing device **702** may be configured in a variety of ways to support user interaction.

The computing device **702** is further illustrated as being communicatively and physically coupled to an input device **714** that is physically and communicatively removable from the computing device **702**. In this way, a variety of different input devices may be coupled to the computing device **702** having a wide variety of configurations to support a wide variety of functionality. In this example, the input device **714** includes one or more keys **716**, which may be configured as press-sensitive keys, mechanically switched keys, and so forth.

The input device **714** is further illustrated as include one or more modules **718** that may be configured to support a variety of functionality. The one or more modules **718**, for instance, may be configured to process analog and/or digital signals received from the keys **716** to determine whether a keystroke was intended, determine whether an input is indicative of resting pressure, support authentication of the input device **714** for operation with the computing device **702**, and so on.

Various techniques may be described herein in the general context of software, hardware elements, or program modules. Generally, such modules include routines, programs, objects, elements, components, data structures, and so forth that perform particular tasks or implement particular abstract data types. The terms "module," "functionality," and "component" as used herein generally represent software, firmware, hardware, or a combination thereof. The features of the techniques described herein are platform-independent, meaning that the techniques may be implemented on a variety of commercial computing platforms having a variety of processors.

An implementation of the described modules and techniques may be stored on or transmitted across some form of computer-readable media. The computer-readable media may include a variety of media that may be accessed by the computing device **702**. By way of example, and not limitation, computer-readable media may include "computer-readable storage media" and "computer-readable signal media."

"Computer-readable storage media" may refer to media and/or devices that enable persistent and/or non-transitory storage of information in contrast to mere signal transmission, carrier waves, or signals per se. Thus, computer-readable storage media refers to non-signal bearing media. The computer-readable storage media includes hardware such as volatile and non-volatile, removable and non-removable media and/or storage devices implemented in a method or technology suitable for storage of information such as com-

puter readable instructions, data structures, program modules, logic elements/circuits, or other data. Examples of computer-readable storage media may include, but are not limited to, RAM, ROM, EEPROM, flash memory or other memory technology, CD-ROM, digital versatile disks (DVD) or other optical storage, hard disks, magnetic cassettes, magnetic tape, magnetic disk storage or other magnetic storage devices, or other storage device, tangible media, or article of manufacture suitable to store the desired information and which may be accessed by a computer.

"Computer-readable signal media" may refer to a signal-bearing medium that is configured to transmit instructions to the hardware of the computing device **702**, such as via a network. Signal media typically may embody computer readable instructions, data structures, program modules, or other data in a modulated data signal, such as carrier waves, data signals, or other transport mechanism. Signal media also include any information delivery media. The term "modulated data signal" means a signal that has one or more of its characteristics set or changed in such a manner as to encode information in the signal. By way of example, and not limitation, communication media include wired media such as a wired network or direct-wired connection, and wireless media such as acoustic, RF, infrared, and other wireless media.

As previously described, hardware elements **710** and computer-readable media **706** are representative of modules, programmable device logic and/or fixed device logic implemented in a hardware form that may be employed in some embodiments to implement at least some aspects of the techniques described herein, such as to perform one or more instructions. Hardware may include components of an integrated circuit or on-chip system, an application-specific integrated circuit (ASIC), a field-programmable gate array (FPGA), a complex programmable logic device (CPLD), and other implementations in silicon or other hardware. In this context, hardware may operate as a processing device that performs program tasks defined by instructions and/or logic embodied by the hardware as well as a hardware utilized to store instructions for execution, e.g., the computer-readable storage media described previously.

Combinations of the foregoing may also be employed to implement various techniques described herein. Accordingly, software, hardware, or executable modules may be implemented as one or more instructions and/or logic embodied on some form of computer-readable storage media and/or by one or more hardware elements **710**. The computing device **702** may be configured to implement particular instructions and/or functions corresponding to the software and/or hardware modules. Accordingly, implementation of a module that is executable by the computing device **702** as software may be achieved at least partially in hardware, e.g., through use of computer-readable storage media and/or hardware elements **710** of the processing system **704**. The instructions and/or functions may be executable/operable by one or more articles of manufacture (for example, one or more computing devices **702** and/or processing systems **704**) to implement techniques, modules, and examples described herein.

## CONCLUSION

Although the example implementations have been described in language specific to structural features and/or methodological acts, it is to be understood that the implementations defined in the appended claims is not necessarily limited to the specific features or acts described. Rather, the specific features and acts are disclosed as example forms of implementing the claimed features.

What is claimed is:

**1**. A method implemented by a power adapter comprising:

connecting a host computing device to a source of external power to supply power to the host computing device from the source of external power via a power manager module of the power adapter that operates to switch circuitry of the power adapter to toggle between different power modes associated with different power levels, the power adapter external to the host computing device;

supplying low power by the power adapter from the source of external power in a low power mode upon initial connection of the power adapter to the host computing device to power a microcontroller for performance of power management tasks without supplying power to a primary processing system of the host computing device;

detecting a notification from the host computing device configured to indicate to the power adapter that the host computing device is ready for high power from the source of external power, the notification communicated by a power controller of the host computing device for recognition and handling by the power manager module of the power adapter to initiate a switch to a high power mode; and

supplying by the power adapter high power in a high power mode to the host computing device in response to detection of the notification.

**2**. A method as described in claim **1**, wherein the notification is a patterned signal generated by a power controller of the host computing device.

**3**. A method as described in claim **2**, wherein the patterned signal comprises a repeating pattern of voltage pulses.

**4**. A method as described in claim **1**, wherein supplying high power comprises causing the power adapter to switch from the low power mode to the high power mode by decreasing an amount of resistance applied in power supply circuitry of the power adapter.

**5**. A method as described in claim **1**, wherein the power adapter is configured to output substantially constant voltage and vary an amount of current output to implement multiple power modes including the low power mode and the high power mode.

**6**. A method as described in claim **1**, wherein the low power supplied by the power adapter is sufficient to operate a microcontroller of the host computing device configured to generate and communicate the notification responsive to a determination that the host computing device is ready for high power.

**7**. A method as described in claim **1**, further comprising recognizing an initial connection of the power adapter to a power source and causing the power adapter to operate in the low power mode until the notification from the host computing device is detected.

**8**. A method as described in claim **1**, wherein:

the power adapter incorporates a five pin connector connectable to an adapter interface of the host computing device; and

one of the five pins is configured to form a communicative coupling to the host computing device when connected to the adapter interface that is employed to convey the notification from the host computing device to the power adapter.

9. A method implemented by a host computing device comprising:

obtaining a low power supply in a low power supply mode from a power adapter external to the host computing device and configured to connect the host computing device to an external power source, the low power supply sufficient to operate a power controller of the host computing device to perform power management tasks without supplying power to a primary processing system of the host computing device;

detecting connection of the power adapter to an adapter interface of the host computing device;

determining whether the host computing device is ready for high power from the power adapter based at least in part upon identifying data obtained from the power adapter indicative of an adapter type of the power adapter;

responsive to determining that the host computing device is ready for high power from the power adapter:

generating a notification for communication to the power adapter for recognition and handling by a power manager module of the power adapter to cause the power adapter to switch to a high power supply mode; and

obtaining a high power supply from the power adapter in the high power supply mode in response to communication of the notification.

10. A method as described in claim 9, wherein the detecting and generating are performed by a power controller of the host computing device that operates independently of a primary processing system of the host computing device.

11. A method as described in claim 9, wherein the notification comprises an alphanumeric code.

12. A method as described in claim 9, wherein the notification comprises a non-random signal pattern.

13. A method as described in claim 9, further comprising communicating the notification to the power adapter via a single pin communication channel established by the connection of the power adapter to the adapter interface.

14. A method as described in claim 9, wherein determining whether the host computing device is ready for high power from the power adapter comprises ascertaining whether a connector of the power adapter is attached properly to the adapter interface of the host computing device.

15. A method as described in claim 9, wherein determining whether the host computing device is ready for high power from the power adapter comprises verifying whether power output supplied by the power adapter is compatible with the host computing device.

16. A power adapter for a host computing device comprising:

a connector configured to connect the power adapter to the host computing device, the power adapter being external to the host computing device and connectable to an external power source to supply power to the host computing device;

power supply circuitry of the power adapter configured to provide a low power supply in a low power mode and a high power supply in a high power mode to the host computing device, the lower power supply being sufficient to operate a power controller of the host computing device to perform power management tasks without booting the host computing device; and

a power manager module operable to selectively switch between supplying power to the host computing device in the low power mode upon initial connection of the power adapter to the host computing device to power the power controller of the host computing device and the high power mode responsive to detecting feedback from the host computing device configured to indicate to the power adapter that the host computing device is ready for high power, the feedback communicated by the power controller of the host computing device for recognition and handling by the power manager module.

17. A power adapter as described in claim 16, wherein the power manager module is configured to cause an amount of resistance applied in the power supply circuitry to change to selectively switch between the low power mode and the high power mode, such that different current levels are output in the low power mode and the high power mode.

18. A power adapter as described in claim 16, wherein the feedback comprises a pulsed voltage signal that is received by the power manager module from the power controller of the host computing device, the pulsed voltage signal being communicated by the power controller responsive to a determination that the host computing device is ready for the high power supply and configured to cause the power manager module to switch to the high power mode.

19. A power adapter as described in claim 16, further comprising a microcontroller hardware device configured to implement the power manager module integrated with the power adapter.

20. A host computing device comprising:

an adapter interface connectable to a power adapter external to the host computing device configured to connect the host computing device to an external power source;

a power controller configured to:

obtain a low power supply in a low power supply mode, the low power supply sufficient to operate the power controller of the host computing device to perform power management tasks without supplying power to a primary processing system of the host computing device;

detect connection of the power adapter to the adapter interface;

determine whether the host computing device is ready for high power from the power adapter based at least in part upon identifying data obtained from the power adapter indicative of capabilities of the power adapter; and

responsive to determining that the host computing device is ready for high power from the power adapter:

generating a notification for communication to the power adapter for recognition and handling by a power manager module of the power adapter to cause the power adapter to switch to a high power supply mode; and

obtaining a high power supply from the power adapter in the high power supply mode in response to communication of the notification.

* * * * *